GAS JOURNAL

LIGHT ⁘ HEAT ⁘ POWER ⁘ BYE-PRODUCTS

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Editorial Notes.

What of the Small Works?

Is there a problem of the small works? There is; and though the works may be small, the problem is a big one. The question was asked by Mr. W. W. Townsend, of Colchester, at the conclusion of a paper which he read a week ago before the Southern Association of Gas Engineers and Managers. The answer is our own; and we make it without hesitation. The matter so far is easy. It is when one proceeds carefully to consider what can be done that the many aspects of the question begin to present themselves. They must all be discussed, and satisfactorily disposed of; but before any progress whatever is attempted, there is one thing which must be made abundantly clear, and it has to do with the personal aspect.

This one thing was brought to the notice of the meeting by Mr. W. M. Mason, who, while stating that his object was not so much to deal with the paper as to enter a protest, made a point which goes to the root of the whole matter. It is impossible that the problem can be calmly and judicially weighed in all its bearings until it is clearly realized that the efficiency of a small works can be discussed without making any reflection upon the manager. The efficiency of a works and the efficiency of a manager are by no means one and the same. In what he said in defence of the manager of the small works, Mr. Mason had the sympathy of the entire meeting; and several of the subsequent speakers bore eloquent testimony to the good work done by these managers, often under exceptionally trying conditions. But this is exactly why Mr. Mason's remarks went to the root of the whole matter. In spite of all the efforts of these managers, the problem remains. Sometimes ill-paid, and at others ill-judged, overwork themselves as they may—the problem is still there. It is an impersonal one.

Having said so much, let us approach this impersonal problem by satisfying ourselves as to the outlook. How can this be done? Hardly by reflecting upon the present, and certainly not by a study of the past. Time was when the smallest possible staff of the smallest possible works could give the consumers what they required. At the present day such a staff could not—with the best will in the world—even begin to furnish the possible service that gas is able to offer. Then what of the future? It is not, as Mr. Townsend stated, likely that any sort of gas can be sold indefinitely at any sort of price. Consumers of a small undertaking may, and in fact very often do, pay a higher price for a less satisfactory service than they would obtain from a larger undertaking; but how long will they continue to do so after an alternative supply of heat energy becomes available? The answer is a fairly simple one. "Small works" is of course a relative definition; but it may be taken here to refer to works of such a size as to preclude the employment of the skilled staff and the installation of the up-to-date apparatus which are necessary to give the service which the consumers know full well is available in the areas of bigger undertakings.

Whether or not an amalgamation or grouping is likely to be profitable to the parties directly concerned, is a matter only determinable by the circumstances of each individual case. But whatever may be the conclusion arrived at on this basis, it must be clear that the industry as a whole stands to benefit by the passing of those undertakings which have not that service and that price by which alone the satisfaction of the consumer can be permanently maintained, into the control of those other undertakings which, by reason either of greater size or happier circumstances of other kinds, possess those advantages which are essential to keep the gas industry in the forefront. Competition is keen; it will grow far keener still—and more than likely it will develop in large measure over districts served by the smaller gas-works. Now is the time for the industry to equip itself for the fray. The method of equipment must depend upon the factors governing individual cases; but, in one way or another, preparation must be made, and made promptly, for the time when only the best service which the best undertaking can offer will be good enough to keep gas where it is.

We are not now discussing the question from the point of view of individual cases, but from that of the industry in general. It is evident, however, that, quite apart from any consideration referred to here, amalgamations, big and little, where they offer good opportunities from a business aspect will continue to be the order of the day. Instances from different quarters, which have proved profitable to all concerned, were quoted at the Southern Association meeting; and as we write there is before us the published notice by the Gas Light and Coke Company of their intention to promote a Bill to authorize the acquisition by them of the undertakings of the Grays and Tilbury Gas Company and the Pinner Gas Company, Ltd. To such transactions as these the following remark by Mr. Townsend obviously applies: "No doubt, there are many cases "in which it would be economical and advantageous for "a large works to take over smaller neighbours, and to "supply them with gas; but each case must be considered "on its merits, and hasty generalizations should be "avoided."

Mr. Townsend and the various members of the Southern Association who took part in the discussion of his paper have made available much useful information upon a subject of pressing importance. It is for each one to study this information in the light of his own position. Desirable as a formula might be, it is to be feared that none can be produced.

Active Carbon for Sulphur Removal.

RIDDING coal gas of sulphuretted hydrogen by the oxide of iron process is commercially efficient when the site of the gas manufacturing plant is not cramped. This commercial efficiency has, in fact, been so good that until recent years comparatively little effort has been exercised in an endeavour to find an alternative system equally efficient and even more economical. There is another point in favour of the oxide process, though perhaps not to the advantage of gas-works practice generally—that it functions without an enormous falling-off in efficiency when little scientific attention is paid to it. There is, moreover, not only a sense of satisfaction, but also a certain fascination, in that revivification is carried out so simply, and that, if anything should go amiss in the boxes, a dose of air will probably provide adequate remedy.

The simplicity of oxide purification is at once its justification and its disadvantage. We say "disadvantage" because we think that the capital cost on the oxide plant is regarded as a necessity, and that its bearing on the price of gas is often forgotten. This capital cost is not merely that entailed in the plant as such—and even concrete purifiers are not cheap—but includes the value (and, important in view of extensions, the potential value) of the space occupied by the boxes and the revivification area. There is also another aspect of the matter. When carbonizing plant is being erected, considerable space is of necessity occupied as storage ground for the materials of construction; and it is not by any means uncommon for this space to be the very area on which the purifiers have to be built. Consequently, one finds that the purifiers have to be erected after the carbonizing plant has been completed, or at any rate is nearing completion. This delay, of course, means dead capital.

We are not in the least averse to the oxide process of sulphur purification. We are, indeed, very fond of it; but experience has made us realize that situations arise on gas-works in cramped areas where additions to the gas-making capacity of the plant are almost impossible simply on account of the space occupied by further purifying plant of the usual type. And for this reason, among others, we draw attention to what we regard as a most important contribution to the technical matter which is published in later columns to-day. This contribution is a translation of a section of the 1928 Report of the Committee on Gas Manufacture of the Association Technique de l'Industrie du Gaz en France, and describes a large installation (which the Committee have visited) at Recklinghausen, and a still larger one at Leuna, for the purification of gas by activated carbon. The arrangement and working of the plants are admirable, and will well repay careful study by gas engineers in this country.

For the process, the carbon used is made from lignite coke activated by steam at 900° C.; and the price is only one-tenth of that of the material employed for benzole recovery. The operation of the process is simple. Briefly, it consists of passing the gas, together with a small quantity of ammonia (which acts as a catalyst) and water or steam, through a bed of the activated carbon. After a certain time, the sulphur extracted by the carbon is washed out by a solution of ammonium sulphide, and the carbon steamed for further use. In all, about a hundred cycles can be performed before it becomes necessary for the carbon to be revivified. In the article ample data on the amount of sulphuretted hydrogen extracted per pound of carbon employed are included; and from our knowledge of the present cost of activated carbon used for benzole recovery, we have been able to satisfy ourselves that the cost of the process compares favourably with that of oxide purification. The ground space occupied by the plant, in relation to the quantity of gas treated, is commendably small; the sulphur recovered is in practically a pure state, and will command good prices; transport charges of this sulphur will be small in comparison with those of spent oxide; and labour costs will be reduced.

The foregoing are the arguments for the process. Naturally one requires the arguments against it; and perhaps our readers will have something to say on this score. We should welcome their comments—our correspondence columns are open to them. As a matter of fact, the system, both at Recklinghausen and at Leuna, has not been working sufficiently long to arrive at any definite conclusions regarding the incidence of capital cost; and we await further information with keen interest, albeit without grave pessimism. We have, however, one feeling of anxiety: What will be the cost of the corrosive properties of ammonium sulphide solution on pumps and plant generally?

From Ash to Ashes.

IT is a matter for commendation that six papers dealing with the subject of coal cleaning should be presented at the Second International Conference on Bituminous Coal which is taking place this week in the Carnegie Institute of Technology, Pittsburgh. Experts from four countries (Great Britain, the United States of America, France, and Germany) are giving their views on various phases of a problem which is of far greater importance—particularly to the carbonizing industries—than is generally appreciated. With regard to Great Britain, Dr. R. Lessing is contributing to the proceedings of the conference to-day a paper bearing the title "The Rational Cleaning of Coal." When, in the "JOURNAL" for Nov. 7, we called attention to the fact that the Bradford Gas Department, in their new coal contracts, have agreed with a colliery company who have installed dry cleaning plant to base their prices on a standard ash content of 6 p.ct., the thought recurred to us that the literature on the subject of coal cleaning was meagre. Since then a comprehensive treatise by W. R. Chapman and R. A. Mott has opportunely been published, and the question is discussed in an admirable mannner in a new book on "The Economics of Coal Mining" written by Prof. Robert W. Dron, who is Vice-President of the Institution of Mining Engineers. Both these books are noticed in later columns of our issue to-day.

Prof. Dron maintains that the salvation of the British export trade may lie in the cleaning of coal; and the same thought is expressed by Prof. R. V. Wheeler in a preface to the book by Chapman and Mott. With wisely tempered enthusiasm, however, Prof. Dron emphasizes—and proves by a series of graphs based on practical results—that, while it may be more profitable for one consumer to purchase the purest coal available, it may pay another consumer to buy coal at a lower price with a considerable percentage of ash. We suggest that the carbonizing industry falls into the former class. The loss of efficiency in an industrial boiler plant due to the ash percentage in the coal is a varying item depending largely on the construction of the plant and its capacity in relation to the steam requirements; but the continuous loss of efficiency in a carbonizing plant is much more costly and far more serious. Let us consider the question rather more closely. A gas undertaking which purchases a dirty coal at the outset has one marked advantage—it obtains its raw material cheaply. This cheapness, however, is largely mythical, and is confined to the pit-head. Transport of dirt costs money; reduced throughput during the process of carbonization implies that the capital sunk in the plant is not being employed to the best advantage; and the cost of heating useless material to (say) 800° C., and of handling and re-handling it, must be enormous.

This, however, by no means ends the story—it is, in fact, a mere introduction to a tale which is far from romantic. As we said last week, there is no possible excuse for any gas undertaking which does not exercise every endeavour to market a good coke. To advertise "service," to imbue people with the idea (a right notion) that it is a selfish act to pollute the atmosphere with smoke, and then to offer them instead of coal a substitute, in gas coke containing (say) one-fifth of its weight of useless, dirty ash, which adds inefficiency to inconvenience, is an extraordinary method of doing business. It can hardly be termed the royal road to goodwill. The same reasoning, of course, applies to the smokeless fuel made by low-temperature carbonization. Whether or not this treatment is carried out at gas-works or by low-temperature concerns does not affect the argument; and it is because of this that we regard with diluted enthusiasm the balance-sheets of low-temperature carbonization undertakings which are based on a raw material containing a vast proportion of mineral matter. The need for the adoption of some form of cleaning is, therefore, apparent; and this means an additional first cost (which, however, is wise

expenditure). The more we study the problem, the more convinced we become that in a comparatively few years low-grade fuels, if employed as a basis for smokeless domestic coke or semi-coke, will have to be subjected to some form of cleaning process. This will add to the selling price of these coals, which, with stimulated demand, will already be in a position to command higher prices in the uncleaned state.

There are, of course, two methods of coal cleaning—the wet and the dry. The former has one very great disadvantage. One of the chief arguments in favour of cleaning coal is that the major part of the cost of handling and transporting dirty coal is a direct loss to the consumer. The water remaining in the coal after washing is equally valueless; and all the cost of handling and transporting the water in the wet coal is also a direct loss to the consumer. Thus, assuming the same efficiency of refuse removal, at the same cost, dry cleaning holds a considerable advantage over wet washing to most consumers, and particularly to the gas industry. It is unfortunate that, on the smaller sizes of coal, dry cleaning processes are not so efficient as wet processes; for wet coal adds to the time of carbonization, introduces additional sources of expense, and adversely affects ammonia recovery. Chapman and Mott sum up the general situation in the following terms: "It is difficult to place a monetary "value on the advantage of dry cleaning rather than wet "cleaning. With nut coal, from which the water can "drain almost completely, there is little, if any, advan-"tage. . . . With small coal, however, there may be, for "the majority of purposes, a certain advantage; but in "the present state of our knowledge a true comparison "of the relative values of wet and dry coals for coke "manufacture cannot be given." For gas manufacture, it certainly appears to us that the advantages of dry cleaning are overwhelming.

Annual Meeting of the Institution.

At a meeting of the Council of the Institution of Gas Engineers which was held on Nov. 12, and a report of which is published in this issue of the "JOURNAL," it was decided that the annual general meeting of the Institution in London next year should take place on June 4 to 6.

Sulphate of Ammonia Consumption.

The increase in the production and consumption of nitrogen during the year ended June 30 last is the largest which has ever taken place in a single year, and is equivalent to the total annual world output of 25 years ago. This is one of the statements contained in the eighth annual report of the British Sulphate of Ammonia Federation. While the Chilean producers have reason to congratulate themselves on an average increase of 42 p.ct. in the world consumption of their product, Chilean nitrate contributed only about 24 p.ct. of the total output of nitrogen in the world during the year. Producers of other forms of nitrogen—chiefly synthetic—have secured an increase of about 16 p.ct. in consumption; and prices for sulphate of ammonia show a reduction of about 7 p.ct. compared with those for 1926-27. Extraordinary expansion in the use of nitrogen has taken place in the United States and the Far East; and the European countries, with the exception of Germany, all consumed more.

Bye-Product Sulphate.

The continued popularity of sulphate of ammonia is evinced by a steady increase of about 13 p.ct. in its use. It is still the most widely employed of nitrogen fertilizers. Of course, much of this sulphate was synthetically produced. As Mr. P. Parrish observed in his World Power Fuel Conference paper on "Some Technical and Economic Aspects of the Bye-Product Ammonia Recovery Problem," whereas the largest bye-product works produces 25,000 tons of ammonium sulphate per annum, Billingham, according to the modified schemes propounded by Lord Melchett at the Adriatic Conference (referred to in the report of the Federation), will produce 360,000 tons per year. As we have already noted in the "JOURNAL," Mr. Parrish urges that, to compete with such an organization, the recovery of ammonia at the majority of gas-works should proceed only to the point of making either a concentrated gas liquor on a 40 p.ct. solution of ammonium sulphate. These concentrated liquids should be converted into ammonium sulphate of uniform quality at a central works. And Dr. E. W. Smith and Mr. T. Campbell Finlayson, in the "JOURNAL" for Nov. 7, observe that, by centralization of ammonia product works, mass production methods, and co-operation between a group of gas undertakings, it is difficult to see how any synthetic process can seriously compete with bye-product ammonia. A ton of bye-product ammonia can be made for £3 18s. It is highly questionable whether a ton of synthetic ammonia will ever be produced at this figure. The price of neutral sulphate (20·6 p.ct. nitrogen) at May last was £10 13s., compared with £24 11s. in May, 1921.

Membership of the Federation.

On June 1 last, the membership of the British Sulphate of Ammonia Federation was 403 (a decrease of 3 on 1926-27), whose annual production represents about 91 p.ct. of the total annual output in Great Britain and Ireland. The decrease is due to alterations in constitution and amalgamations, not to withdrawals. Mention is made in the report that the agreement between the Federation, Imperial Chemical Industries, Ltd., and Nitram Limited was approved by the Executive Committee, and signed during the year.

Travelling Directors.

A "Financial Times" Special, on Monday of last week, put forward a strong plea for the appointment by British manufacturing firms of what in Germany are known as Travelling Directors, who go from country to country collecting orders, which they are often able to obtain because of their powers to negotiate with potential customers without consulting headquarters. Such men are chosen solely for their proficiency in the art of salesmanship; and it is found that they perform most useful work, while leaving the organization of the head office undisturbed. Most countries, it is said, have adopted the system of a Travelling Salesman-Director, who does not participate in the administration of the company. The writer of the article contrasts this new method of approach with the British plan of sending Chairmen or ordinary Directors (who are needed at headquarters) abroad in search of business; and the comparison greatly favours the more modern plan.

Production of Coke in Germany.

In the Report of Mr. J. W. F. Thelwall (Commercial Counsellor, Berlin) on the Economic and Financial Conditions in Germany (to June, 1928), which has just been issued by the Department of Overseas Trade, it is stated that the upward movement in the production of coke which had set-in in the Ruhr at the end of 1926 continued during 1927, and reached a total of about 27 million tons for the year. The steady rise in production was due to the lively demand resulting from the intense industrial activity in general, and more particularly to the high level reached and maintained by the iron and steel production. Further, there was a marked demand for small coke for central heating boilers. This larger consumption of coke and, connected with it, the whole question of bye-products, have encouraged the works to renew their antiquated cokeries more and more, and to introduce the most modern plant. As illustrating the great advances which are being made, it may be stated that up to October, 1928, applications for increased participation in the Coke Syndicate amount to over 11 million tons; the Vereinige Stahlwerke alone having applied for an increase of 4 million tons in their quota.

Coal Distillation in Germany.

As regards the liquefaction of coal, the report states that the Leuna Works of the I. G. Farbenindustrie still occupy the predominant position. The chief advance which has been made is the erection of an experimental plant at Duisburg-Meiderich by the A.G. für Kohleveredlung, which is operating on the Bergius-Billweiler process. This plant will deal with 30,000 tons of coal per annum and produce some 13,000 to 15,000 tons of marketable oil annually. In low-temperature distillation of bituminous coal, in addition to the plant of the Kohlenscheidungs-gesellschaft at Karnap, which is reported to be working satisfactorily, the Plassmann plant of the Chemisch-Technische Gesellschaft, Duisburg, is stated to hold out prospects of commercial success. This Company are working their first plant

(of a daily capacity of 50 tons of coal) at the Prosper Mine of the Rheinische Stahlwerke. With regard to the low-temperature distillation of brown coal, the A.G. für Kohleveredlung have erected a plant at the Minna Anna Mine at Gölzau, near Bitterfeld, which will be put into operation in the near future, and will deal daily with 1500 tons of raw brown coal.

Safeguarding Duties.

While the Prime Minister has given his assurance that the principle of safeguarding will not be extended, unless and until the electorate gives its authority, new lines of procedure in connection with applications have been announced. A permanent tribunal is to be set up by the President of the Board of Trade, similar to that under the Merchandise Marks Act, to hear applications for safeguarding. The Government, however, will not be bound by the findings of any such tribunal. If the applicants make out their case, the House of Commons will be left to give its verdict as to whether the employment of people in this country shall or shall not be protected to this extent. The conditions of application are to be altered in various respects. A new requirement will be that the applicant industry shall be able to show that it can materially increase its present output. On the other hand, it will no longer be necessary for the industry making application to prove that it is an industry of substantial importance, nor will it be required to show that the imported foreign goods are being offered for sale here at prices below those at which similar goods can be profitably produced in the United Kingdom. Another important change has been made in the conditions regarding the amount of imports. At present an industry must show that goods are being imported into, and retained for consumption in, the United Kingdom in abnormal quantities. In the new conditions there is no reference to abnormal quantities. What an applicant industry must now be able to show is that the imports are in quantity "substantial in proportion to domestic consumption."

Unemployment Insurance Deficiency.

In moving the second reading of a Bill to authorize an increase of the outstanding amount, during the deficiency period, from £30,000,000 to £40,000,000, of Treasury advances for unemployment benefit insurance benefits, the Parliamentary Secretary to the Ministry of Labour said that the measure also secured the right of Parliament to review the situation if the larger sum mentioned should prove to be inadequate. The advances outstanding in the early part of this month amounted to £29,320,000, as against a debt at March 31, 1926, of £7,178,000. These figures indicate the cost, in one direction only, of what the Parliamentary Secretary was satisfied to term the "unfortunate disturbances of 1926." In other directions the cost must have been even greater. Everything has in due season to be paid for; and it is to be hoped that irresponsible "leaders" will in future remember that the cost of general strikes is bound to be heavy, and out of all proportion to any advantage that is likely to be gained. Meanwhile, it is anticipated that the additional £10,000,000 will, in circumstances even worse than any contemplated, last very nearly a year.

PERSONAL.

As from the end of this month, Dr. A. PARKER resigns from the position of Research Chemist to the Institution of Gas Engineers, in order to take up his duties as Assistant Director of Water Pollution Research, Department of Scientific and Industrial Research, to which post he has recently been appointed. The industry will unite in offering to Dr. Parker the warmest congratulations upon his appointment, but will couple with them general regret that his talents will no longer be exercised solely on its behalf. We have Dr. Parker's assurance, however, that his interest in the industry will not diminish; and we look forward to such contributions from his pen as his new duties permit.

Mr. J. FERGUSON BELL, M.Inst.C.E., M.I.Mech.E., formerly Engineer and Manager of the Stafford Gas-Works, and now Engineer and General Manager of the Derby Gas Light and Coke Company, has been elected Mayor of Derby after thirteen years' service on the Council. In proposing Mr. Bell's election, Alderman Hart outlined his municipal career, giving special mention to his valuable work in connection with the Finance and Water Committee, and with the river drainage scheme. Mr. Bell was elected by a unanimous vote, and cordial wishes for a happy and successful year of office were extended. Mr. Bell began his professional career at Birkenhead. During the time he was at Stafford, the gas-works were considerably enlarged, and he took over the charge of the electricity works, which he planned in conjunction with the late Dr. John Hopkinson, F.R.S. On Saturday, Nov. 10, Mr. Bell entertained Mr. Ramsay MacDonald to luncheon on the occasion of his visit to Derby.

Mr. W. F. CATON, son of Mr. W. E. Caton, M.Inst.C.E., M.I.Mech.E., General Manager and Engineer of the Oxford Gaslight and Coke Company, was a successful candidate at the recent Preliminary Examination held at the Institution of Civil Engineers.

OBITUARY.

We are deeply grieved to learn, as we go to press, of the death of Mr. FREDERICK GEORGE COCKEY, who passed away on the 18th inst., at the age of 69, at the White Cottage, Avenue South, Surbiton, after a few days' illness. The funeral will be to-morrow (Thursday), at 11 o'clock, at Surbiton Cemetery, Marsh Lane. The service is to be held in the Chapel there. An extended notice will be given in our next issue.

The death occurred at Pollokshields, Glasgow, on Nov. 11, of Mr. ANDREW EADIE, Chairman of the Scottish Tube Company, Ltd., of Glasgow. Mr. Eadie was the oldest member of the tube trade, and was formerly principal partner of the firm of James Eadie & Sons, Clydesdale Tube Works, Rutherglen. This firm was founded in 1832, and was the first to manufacture gas tubes in Scotland. During his long connection with the firm, Mr. Eadie was identified with the development of iron boiler tubes, particularly for use in marine boilers, and also with the development of loose flange tubes and joints for the colliery trade. When the firm was incorporated in the Scottish Tube Company, Mr. Eadie became Vice-Chairman, and at the death of Sir Thomas Mason, in 1924, was appointed Chairman and Managing-Director. Mr. Eadie has always taken a very active share in the management of the Company, and was at business every day up till two days before death. He was in his 75th year.

FORTHCOMING ENGAGEMENTS.

Nov. 24.—NORTH OF ENGLAND GAS MANAGERS' ASSOCIATION (AUXILIARY SECTION).—Meeting at the Howdon Works of the Newcastle and Gateshead Gas Company, at 2 p.m. Address of the Chairman, Mr. G. E. Anderson, B.Sc.

Nov. 30.—LONDON AND SOUTHERN DISTRICT JUNIOR GAS ASSOCIATION.—Meeting at the Westminster Technical Institute, 7.30 p.m. Paper by Mr. A. T. Green, F.Inst.P., A.M.I.Chem.E.

Dec. 1.—WESTERN JUNIOR GAS ASSOCIATION.—Meeting. Paper by Mr. C. C. Brice entitled "The Industrial Load in Bristol."

Dec. 1.—MANCHESTER AND DISTRICT JUNIOR GAS ASSOCIATION.—Meeting at Preston. Paper by Mr. A. K. Collinge, of the Preston Gas Company, on the "Working and Development of the 'Regenerative' Complete Gasification System."

Dec. 1.—SCOTTISH JUNIOR GAS ASSOCIATION (WESTERN DISTRICT).—Meeting in the Royal Technical College, Glasgow. Short papers by Mr. R. Lappin, of Glasgow, on "Street Lighting and Equipment;" and by Mr. J. Webster, of Port Glasgow, entitled "A Kodak at the Gas-Works."

Dec. 8.—SCOTTISH JUNIOR GAS ASSOCIATION (EASTERN DISTRICT).—Meeting and visit to the Leven Gas-Works and the Durie Foundry, Leven.

Dec. 8.—WALES AND MONMOUTHSHIRE JUNIOR GAS ASSOCIATION.—Meeting, and visit to the National Oil Refineries at Llandarcy.

Dec. 12.—BRITISH COMMERCIAL GAS ASSOCIATION.—Meetiag of the Executive Committee, 3 p.m.

Dec. 12.—SCOTTISH JUNIOR GAS ASSOCIATION (WESTERN DISTRICT).—Visit to the Union Works of the Scottish Tube Company, Ltd., Coatbridge.

Dec. 15.—YORKSHIRE JUNIOR GAS ASSOCIATION.—Meeting at Leeds University. Paper by Mr. H. J. Hodsman, M.Sc., on "The Radiation from Gas Burners."

Dec. 19.—BRITISH COMMERCIAL GAS ASSOCIATION.—Meeting of the General Committee, 2 p.m.

INSTITUTION OF GAS ENGINEERS.

Nov. 23.—Liquor Effluents Committee, 2.30 p.m.

Dec. 4.—Finance Committee, 10.45 a.m.; Executive Committee, 11.30 a.m.; Council, 2.30 p.m.

Dec. 11.—Gas Education Executive Committee, 4 p.m.

NATIONAL GAS COUNCIL.

Meeting of the Central Executive Board.

A Meeting of the Central Executive Board of the National Gas Council took place on Nov. 13 at 28, Grosvenor Gardens, S.W.—Sir DAVID MILNE-WATSON in the chair.

CONFERENCE AT YORK ON GAS CHARGES.

It was reported that a conference had taken place at York on Oct. 24, during the annual conference of the British Commercial Gas Association, to discuss the advisability of freedom being granted to the gas industry in the matter of charging for gas.

REPORT OF THE NATIONAL FUEL AND POWER COMMITTEE.

It was reported that the Council had been invited to appoint two representatives to serve on the Committee to be set up by the Government in accordance with paragraph 72 of the Report of the National Fuel and Power Committee, to undertake an investigation into the technical and economic aspects of an area gas supply system. The Central Executive Board approved the appointment of two representatives to serve upon the Committee in question.

STATUTORY RESTRICTIONS ON THE USE OF GAS.

Lord Astor's speech during the debate on the King's Speech in the House of Lords on Nov. 8 was reported, in which he drew attention to certain restrictions which prevented the public getting the full use of gas as a source of power, heat, and light. In the course of his speech, he suggested that, if it were found that some of the main points which he had put forward were, in fact, non-controversial, the Government should introduce a Bill in the Lords.

OTHER QUESTIONS.

Discussions ensued, and decisions were taken on the following matters:

(*a*) Exemption from capital duty on the amalgamation of undertakings.
(*b*) Injury to gas pipes due to electrolytic action and fusion.
(*c*) Liability of a gas undertaking in respect of injury to wires and cables the property of the Postmaster-General, due to explosion.
(*d*) Coal.

INSTITUTION OF GAS ENGINEERS.

Council Meeting.

A Meeting of the Council was held at 28, Grosvenor Gardens, Westminster, on Monday, Nov. 12—Mr. John Terrace (President) in the Chair. There were also present Messrs. C. S. Shapley and H. E. Copp (Vice-Presidents), W. E. Caton, P. G. G. Moon, H. C. Smith, T. Carmichael, R. E. Gibson, H. E. Bloor, F. P. Tarratt, W. W. Townsend, and J. W. Whimster (Ordinary Members of Council), J. B. Hansford (Eastern Counties Association), L. W. Dalby (Irish Association), R. H. Ginman (Manchester District Institution), W. G. S. Cranmer (Midland Association), D. Currie (North of England Association), C. V. Bennett (Southern Association), H. D. Madden, J. Wilkinson, and C. F. Botley (Past-Presidents), and W. E. Price (Hon. Secretary).

Selected applicants for the post of Secretary of the Institution were interviewed, and the result will be announced shortly.

It was unanimously resolved that a letter be sent to Dr. Parker, expressing the high appreciation of the Council for the most valuable services which he had rendered to the gas industry as Research Chemist to the Gas Investigation Committee and the Effluents Research Committee, and their congratulations on his appointment as Government Assistant Director of Research on River Pollution.

The report of the proceedings of the Smoke Abatement League Conference held at Harrogate on Sept. 29 and 30 was received from Mr. Frank H. Robinson, delegate of the Institution, and was adopted.

It was reported that the President of the Institution had been elected for the period of his term of office an Hon. Member of the American Gas Association at the Association's Annual Convention in Atlantic City, N.J., on Oct. 9.

It was reported that the following had been elected as District Members of the Council, on the Council of the Institution: Eastern Counties Gas Managers' Association, 1928-29, Mr. J. B. Hansford (Bedford); Wales and Monmouthshire District Institution of Gas Engineers and Managers, 1929-30, Mr. F. Boardman (Cardiff).

The Council rose in sympathy at the announcement of the deaths of the following: Dr. Frederick M. Perkin (Hon. Member), Mr. Charles Dakin, and Mr. S. Meunier (Members).

The following were approved as candidates:

For the Class of Member.—Messrs. W. A. G. Hardy (Beccles), A. H. Holland (San Paulo, Brazil), H. B. Holliday (Wallasey), L. R. Hislop (Dundee), T. Law (Malton, Yorks.), E. Lord (Brisbane), T. G. Moffatt (Glasgow), E. Nock (Newtown, Montgomery), and C. S. Read (Washington, Co. Durham).

For the Class of Associate Member.—Messrs. F. Allen (Scunthorpe), C. W. Dalton (Arbroath), A. G. Grant, M.Sc. (Southall), A. S. Grime (San Paulo, Brazil), O. R. S. Ingham (Colne), R. L. Laing (Brechin), P. Low (Dundee), and W. Verity (Weymouth).

The President reported developments in connection with the application for the Royal Charter.

The date of the annual general meeting to be held in London in 1929 was fixed for June 4 to 6.

A report was received from Mr. C. S. Shapley, Chairman of the Purifier Committee, of a meeting held in York on Oct. 23.

The President was nominated to represent the Institution at a Conference of Engineering Institutions in England, to be convened by the Institution of Civil Engineers, to form a Committee having for its objects the organization of a party of engineers to visit Japan in connection with a World Engineering Congress in Tokyo, October-November, 1929, and the securing of a number of papers covering British Engineering Practice.

EVENING STAR CHAPTER, No. 1719.

Election Convocation.

There was quite a large attendance of members and visiting companions at the Election Convocation of the Evening Star Chapter, No. 1719 (attached to the Evening Star Lodge), which was held at Freemasons' Hall, Great Queen Street, London, on Wednesday evening last.

Ex Comp. Rae P. Normand and Ex Comp. Walter McDowall, the respective Z. and H. of the Chapter, were in their places at the opening of the proceedings, the J. chair being occupied by the D.C.—Ex Comp. Charles Hulme, P.Prov.G.Std.B. Middlesex—Comp. Wallace Hammond, J. elect, having been prevented, owing to illness, from being installed at the previous convocation. After the opening of the Chapter, therefore, he was duly inducted by Ex Comp. McDowall. The P.S. Comp. G. D. Bidwell, and the Janitor, Ex Comp. R. H. Goddard, were also installed in their respective offices.

For admission as a joining member, Comp. Stewart Oswald Pacey, of Retford, was ballotted for and unanimously elected.

Bro. George Coutts, of Birmingham, was then ballotted for, as a candidate for exaltation, and was also unanimously elected. The ceremony was carried out by the three principals, assisted by Ex Comp. Alfred C. Beal, P.Z., as scribe E.; Ex Comp. Arthur Valon, P.Z., as scribe N.; Comp. Bidwell as P.S.; and Ex Comp. Hulme as D.C.

Comp. Stephen Hay, who had been exalted at the previous convocation, was presented with his Grand Chapter Certificate.

The election of principals and officers for the ensuing year resulted as follows:

Ex Comp. Walter McDowall	Z.
Ex Comp. Wallace Hammond	H.
Comp. Frank West	J.
Ex Comp. A. C. Beal, P.Z.	Scribe E.
Ex Comp. Ralph Carr	Scribe N.
Ex Comp. W. A. Surridge, P.G.Std.B.; P.Z.	Treasurer.
Comp. G. D. Bidwell	P.S.
Comp. J. R. Masters	1st A.S.
Comp. C. M. D. Belton	2nd A.S.
Ex Comp. Charles Clare	D.C.
Ex Comp. Walter T. Dunn, L.C.R.	Organist.
Comp. Burt Long	Stewards.
Comp. A. R. Barford	Stewards.
Ex Comp. R. H. Goddard	Janitor.

It was resolved that a Past-Principal's Jewel should be presented to Ex Comp. Normand on his retirement from the Z. chair, as a mark of appreciation of his services to the chapter during his year of office.

A vote of condolence with Ex Comp. Surridge, on the loss he had sustained by the death of his wife, was passed in silence.

A dinner was subsequently held in the adjoining Connaught Rooms under the chairmanship of Ex Comp. Normand and the other two principals. It was followed by observance of the usual Royal Arch Chapter toasts.

BRITISH SULPHATE OF AMMONIA FEDERATION.

EIGHTH ANNUAL MEETING.

[Extracts from the Annual Report will be found in our news columns to-day.]

The Eighth Annual General Meeting of the British Sulphate of Ammonia Federation, Ltd., was held at the Head Office, 30, Grosvenor Gardens, S.W., on Thursday, Nov. 15—Sir DAVID MILNE-WATSON (Chairman of the Federation) presiding.

The SECRETARY (Mr. W. Henderson) having read the notice convening the meeting and the Auditors' report,

The CHAIRMAN, in presenting the eighth annual report of the Federation and the accounts for the 13 months ended June 30, said:

LARGE INCREASE IN PRODUCTION AND CONSUMPTION.

You will see from the report that there was a very large increase in the output of nitrogen in the world during the year. The actual figure was about 420,000 tons of pure nitrogen, equivalent to an increase of 34 p.ct. While the increase in consumption was not sufficiently large to absorb the whole of the increased output, it amounted to the very satisfactory figure of 22 p.ct. As I pointed out at our last meeting, there was only a moderate increase of about 4 p.ct. in the world's consumption during the previous season, but taking the two years together we find an average annual increase of 13 p.ct. This figure suggests that a cumulative increase is still continuing in the world's powers of absorption for nitrogen, for if we take the average percentage increases over the last four or five years we find that the average figure is 11 p.ct. I am pleased to say that estimates which have recently been made regarding the consumption during the present fertilizer year, 1928-29, lead us to expect a further considerable increase. On the other side of the picture, however, we are faced with an increase in production of something like 22 p.ct., assuming that the Chileans carry through their programme and produce 500,000 tons of pure nitrogen. Unless our estimates for the increase in consumption are too conservative, it would appear that at the end of the present fertilizer year we shall reach the position which was predicted in our reports some years ago, when the rate of increase in production will definitely outstrip the increase in consumption.

PRICES.

In view of the favourable statistical position in June, 1928, the chief nitrogen producers in the world decided to maintain the same level of price for nitrogen during 1928-29 as was obtained for the previous year. It cannot be said that that level of price is satisfactory to bye-product producers of sulphate of ammonia, but I am afraid that we shall only be deluding ourselves if we think that any improvement in the price is likely to take place. In this connection I notice that the Chilean nitrate propagandists have recently been taking comfort because the German Nitrogen Syndicate passed on a small increase in railway rate to their home consumers. It has been concluded that the margin of profit on the production of synthetic nitrogen in Germany is very small, and that, therefore, no further reduction in prices is likely to take place in future years. It seems to me that this assumption is very rash, and that the German Nitrogen Syndicate is much more likely to have been acting on the principle that any variation in railway rates which comes into force after "delivered prices" have been declared should be passed on to the consumer. This is a principle on which we have often acted in this country, and on which we propose to act this season if, as we hope, the railway companies reduce the rate on sulphate of ammonia carried as fertilizer for home agricultural use in this country.

COMPETITION WITH CHILEAN NITRATE.

You will all be aware from the numerous articles which have appeared in the Press during the last few months that the Chilean Government and the Chilean nitrate propagandists are making a determined effort to recover their lost markets. As a result of these efforts, not only has the price of Chilean nitrate been very considerably reduced, but considerable improvements have been made in the method of sale. I think it would be foolish for us to ignore these efforts, and I can assure you that our friends, Nitram, Ltd., are taking active steps to counter them. As I have stated on other occasions, we regard Chilean nitrate of soda as an excellent fertilizer when used at the right time and place. But in the interests of our farmer customers we must resist to the uttermost the claim made by the Chilean propagandists that Chilean nitrate is superior to all other nitrogen fertilizers.

INCREASED EXPORTS OF BRITISH SULPHATE OF AMMONIA.

Turning now for a moment to our export markets, you will note with satisfaction that a very remarkable recovery has taken place as far as British trade is concerned. I regret to say that production has not yet completely recovered from the disaster of the coal stoppage and general strike of 1926, but the figures in the report show that we have had sufficient sulphate of ammonia to enable us to regain much lost ground in our overseas markets.

It is particularly gratifying that our sales in Japan rose from 38,000 tons of over 100,000 tons during the year; and the fact that sales in China have again more than doubled leads us to expect still greater developments in that market.

INDIA AND CEYLON.

As regards India and Ceylon, I am pleased to be able to report a substantial increase in the consumption, especially of sulphate of ammonia, which has now reached the respectable figure of 30,000 tons per annum. I referred in my remarks last year to the investigation of Indian agriculture being carried out by a Royal Commission, and I then expressed the hope that the Report of the Commission would indicate ways and means of facilitating the consumption and distribution of fertilizers in that country. Those of you who have read the Report of the Commission will no doubt share my feeling of disappointment. The passages relating to the place to be occupied by artificial fertilizers in Indian agriculture indicate an inadequate grasp of the problem on the part of the Royal Commissioners. Though the Commission has declined to recommend the adoption of the offer which was made by Nitram, Ltd., with the support of Imperial Chemical Industries, Ltd., I understand that our friends intend to pursue their programme. I am pleased to be able to report that the attitude of the agricultural authorities in India has been very helpful.

THE HOME MARKET.

In the home market we have done no more than mark time, but in view of the very difficult period through which farmers passed last season I think we can congratulate ourselves that there was not a heavy fall in the consumption of nitrogen; and I think credit is due to the advisory service of Nitram for the fact that the falling-off in home consumption was so insignificant. You will see that reports from the districts indicate that nitrogen is being applied to at least 50,000 acres of pasture-land under the new system of intensive grassland treatment, and I feel confident that as this system becomes more widely adopted we shall see a very considerable increase in the use of nitrogen at home.

PROPOSED TAX IN SPAIN.

You will have seen in the Press that the Spanish Government is proposing to pay a subvention to the existing makers of synthetic ammonia in Spain, and to raise the necessary fund by the imposition of a tax, which will probably be heavy, on imported sulphate of ammonia. We have protested against this proposal through the proper official channels. We have made it clear that we do not presume to criticize or object to the decision of the Spanish Government to protect the Spanish nitrogen industry, but we claim that this protection should not be given at the expense of imported sulphate of ammonia alone, the bulk of which comes from Great Britain. All we ask is that all forms of nitrogen imported into Spain should receive the same treatment.

The report and accounts having been adopted unanimously, and the Auditors having been reappointed, Sir David Milne-Watson (Gas Light and Coke Company) was re-elected Chairman and Mr. E. J. George (Consett Iron Company, Ltd.) and Mr. S. Henshaw (Staffordshire Chemical Company (1917), Ltd.) Vice-Chairmen of the Federation for the ensuing year.

The proceedings terminated with a vote of thanks to the staff, which was briefly acknowledged by Mr. F. C. O. SPEYER, the General Manager.

International Illumination Commission.—At the opening meeting of the new session of the Illuminating Engineering Society, held on Nov. 6, the President, Mr. C. C. Paterson, C.B.E., Director of the Research Laboratories of the General Electric Company, of Wembley, who was Chairman of the International Illumination Commission which has been sitting in New York, stated that an invitation on behalf of the British Illumination Committee had been given to the International Commission to visit and hold its congress in this country in 1931. A Secretariat of the Commission has been in this country for some years past, and therefore it would be a very happy idea, the President stated, to hold the Commission here. Great Britain was fortunate in having its Illuminating Engineering Society, National Physical Laboratory, British Engineering Standards Association, and other organizations, which, forming a very happy combination, would help to make the proposed visit and congress a success. The year 1931 might seem a long way off, but it would be necessary soon to make plans if we in this country were to reach the high standard of effort and hospitality achieved by our friends in the United States.

The World Fuel Conference and the Gas Industry.

A Retrospect.

By E. W. SMITH, D.Sc., F.I.C., and T. CAMPBELL FINLAYSON, M.Sc.

A Series of Four Articles: III.

SOLID SMOKELESS FUEL.

One aspect of the World Power Conference attracted much attention—namely, the papers and discussions relating to the production and use of solid smokeless fuel. This is not surprising when one considers the wide appeal the subject offers. As Lord Reading, the President of the Conference, expressed it, "A cheap, easily ignitable, smokeless fuel would confer immense benefits upon every industrial country. It would mean a reduction in fog, give sunlight a greater opportunity to use its beneficent rays, and it would mean cleaner homes, cleaner factories, and cleaner streets. The conference will provide an opportunity for the comparing of notes between the two schools—those who favour high-temperature carbonization methods, and those who believe that the future lies with low-temperature carbonization."

LOW-TEMPERATURE CARBONIZATION AND THE DAILY PRESS.

It is in the spirit of the above words that the present writers have set out to discuss the deliberations of the Fuel Conference on the problem of smokeless fuel. It is a subject which, unfortunately, in many cases is discussed from a biased point of view. For example, low-temperature carbonization, one of the most intricate technical and economic propositions of the present day, is dealt with at length in the daily non-technical Press. The process is held out as a panacea for the depressed coalfields; new schemes involving high oil yields and wonderful balance-sheets are described; attention is focussed upon the shares of the various companies in the financial pages. It is therefore of great value to gather from the papers presented to the Fuel Conference some authoritative information on a subject upon which much is written so lightly and so inaccurately.

THE GAS INDUSTRY REALIZES THE NEED.

The gas industry is to-day fully awake to the necessity of facing up to this need for a satisfactory domestic solid smokeless fuel. Coke is no longer looked on as a residue from the carbonization of coal, either to be converted into water gas or sold in any size, with any amount of water, for any price, rather than leave it to lie about on the works. Much attention in recent years has been paid to the improvement of methods of coke production, quenching, grading, utilization, and sales, with the result that gas-works coke is almost an ideal fuel for many purposes. For closed stoves, hot water boilers, large industrial heating appliances, and many industrial processes, carefully graded gas-works coke, containing a reasonably low ash and moisture content, is a fuel which meets the requirements with entirely satisfactory results. In addition (as was stated in the Editorial columns of the "JOURNAL" for Nov. 14) there is abundant evidence that in many cases suitably sized, dry coke from continuous vertical retorts provides a satisfactory fuel for the open grate. From the point of view of the gas industry, the ideal sale for coke is the domestic rather than the industrial market. While there has undoubtedly been an improvement during the past few years, the gas industry must not yet rest content that it has done all in its power to secure this domestic market.

FUELS FOR THE HOME.

Before discussing methods for the production of smokeless fuel by high or low temperature processes, it is necessary first to consider the requirements of such a fuel for domestic uses. Dr. Margaret Fishenden, in her paper entitled "A Comparative Study of Solid Fuel, Gas, Electricity, and Oil for Domestic Purposes" (L.5), gives a most valuable review of the various forms of fuel required in the home. It is pointed out that it is quite impracticable to lay down any very specific general recommendations as to the types of heating or cooking appliances which should be used in order to obtain the "best" results, for the most suitable equipment varies with the requirements. Dr. Fishenden groups the different types of domestic needs in the following classes:

1. *Low Demand for Hot Water and Cooking.*

This represents the average working-class home. In such cases an open sitting-room grate, with a back boiler in the living room, and a gas or electric cooker form a cheap and convenient combination. The fuel saved in the open grate as compared with an ordinary kitchener should be easily sufficient to pay for the gas burned. An all-gas installation would cost considerably more to run, for, though it would heat the same quantity of water at one-half the cost, the difference would not be enough to pay for a gas fire in the cold weather. All electricity would be out of the question.

2. *Heavy Hot Water Demand, Low Cooking Demand.*

Where the hot water load is heavy, but the cooking load light, nothing can compare with a coke-fired boiler run in conjunction with a gas cooker. The boiler should be of a type which can be used with an open fire to warm the kitchen in winter.

3. *Heavy Hot Water Demand, Heavy Cooking Demand.*

If both hot water and cooking loads are heavy, it may become expensive to use a separate coke-fired boiler and gas oven, since for a continuous heavy load a solid fuel range can cook as cheaply as gas, and produces considerable quantities of hot water at the same time.

4. *Sitting Rooms.*

Whatever the kitchen equipment, continuously occupied sitting rooms should be warmed by open coke fires, and intermittently used rooms by gas fires, either alone or with central heating.

Consideration of these suggestions propounded by Dr. Fishenden leads one to the following conclusions:

1. The demand for solid smokeless fuel is likely to be accompanied by a further demand for gas or electricity.
2. There are two different types of solid smokeless fuel required:
   (*a*) For closed stoves and central heating.
   (*b*) For burning in the open grate.

A RATIONAL DEVELOPMENT.

The gas industry is already supplying gas and also fuel for closed stoves and central heating. It would seem a rational development for it also to supply the smokeless fuel for the open grate. It is the supply of a suitable substitute for the forty million tons of domestic coal burned per annum which constitutes the smokeless fuel problem. It is this market which the exponents of low-temperature carbonization hope to capture.

THE COMPETITION OF HOUSE COAL.

For smokeless fuel to be adopted in the place of house coal, it must fulfil certain fundamental conditions. It must be easy to ignite, it must burn without creating dust, it must be easy to store, and it must compete on an economic basis with coal. It must be remembered that, in actual performance in an open grate, solid smokeless fuel has a serious competitor in the form of good house coal. Apart from its smokelessness and improved radiation efficiency,

smokeless fuel has no tangible advantages over house coal. It often has a higher ash content per ton of fuel burned. Therefore it is unreasonable to expect in any large way the purchase of a coal substitute at a materially higher price than good coal.

In order to determine the present position of this subject, the writers propose in this article first to discuss what the exponents of low-temperature carbonization and of high-temperature carbonization are doing towards the production of such a fuel, and secondly to review the evidence of the relative merits in actual use of different types of smokeless fuel, taking as the basis of their information the papers and discussions at the Fuel Conference.

Present Position of Low-Temperature Carbonization.

For the present consideration, in which a substitute for domestic coal is being discussed, notice can only be taken of those processes which deliver a carbonization product of suitable size and strength. Processes which produce only small fuel suitable for pulverized fuel firing do not affect the domestic situation. Dr. Lander and Dr. Sinnatt, in their paper on "Low-Temperature Carbonization" (Q.2), state that at the present time there are some sixteen plants which are capable of dealing with 10 tons or more of coal per day. Of these plants, seven have been tested by the Fuel Research Board. The majority of the plants give a combined yield of from 18 to 22 galls. of tar and spirit washed from the gas when treating bituminous coals.

The Value of Small Coal.

It appeared to be generally accepted at the conference that in a number of the low-temperature processes the actual "retorting" of the coal is an accomplished success. During the discussion, at least two speakers testified that the plants in which they were interested were operating on a full-scale basis, week in, week out. But a technical success does not mean that a national supply of smokeless fuel is at hand. In many cases the economics of low-temperature carbonization depend upon the use of cheap small coal. As long as there is a big demand for large coal there will be available a supply of cheap small coals; but with an increase in the demand for coking slacks for coke ovens and low-temperature processes, and with the great development in blending, there will be a tendency for the disappearance of these cheap coals. As Drs. Lander and Sinnatt express it, "If the household market for the lump coal is filled by fuels made from small coal, whether coal gas, gas coke, oven coke, or low-temperature coke, the natural result will be an increase in the price of the small coal until it bears its full mining cost. On the other hand, the price at which really large quantities of smokeless fuel will appeal to the public will probably be about that of household coal." The ultimate commercial success of low-temperature carbonization would appear to depend upon whether the plants can economically operate between the above limits, taking into consideration the credit obtainable from the sale of the gas and tar.

Low-Temperature Tar.

On the subject of the value of tar from low-temperature processes there was much divergence of opinion. The value at which tar is assessed is the turning-point of many a balance-sheet. At the conference one group, apparently basing their opinions on the prices already obtained for the small quantity of low-temperature tar at present on the market, suggested a figure of from 4d. to 6d. per gallon. On the other hand, others suggested that if the production of low-temperature tar became general, a value of 2½d. per gallon was more likely to become usual. Speakers engaged in the oil refining industry claimed that a new technique of distillation and refining was necessary to suit low-temperature tar, and indicated that the products were in general not of as good a quality as those from petroleum oils. In this connection Drs. Lander and Sinnatt state that "Investigation of low-temperature tar does not appear at this stage to have revealed any special feature likely to raise its commercial value above that of high-temperature tar." Further, the same authors state that, if the amount produced in a particular district or in the country generally is such as to saturate the requirements for the special products derived from tar, the sole method of utilizing the surplus will be as fuel oil. The value of this is given at the present time as 3d. to 3½d. per gallon.

The Possibilities for Great Britain.

Discussing the possible applications of low-temperature carbonization in Great Britain, Dr. Lander and Dr. Sinnatt make the following points. The gas industry could provide a ready market for the rich gas from externally heated retorts. The lower-grade gas from internally heated retorts could also be used to replace the producer gas normally employed for heating high-temperature retorts. The gas companies, having marketing arrangements for coke, could also profitably undertake the sale of solid smokeless fuel. It is to be specially noted that, if the forty million tons of coal used in Great Britain for domestic purposes were replaced by solid smokeless fuel, the production of rich gas would be so great that it would only be possible to dispose of this for town's purposes through the gas industry.

Where Information is Wanting.

Their general conclusion is that, though sufficient is known regarding the technical aspects of low-temperature carbonization to justify the conclusion that plants could be worked to produce smokeless fuel, tar, and gas in adequate quantity and of required quality, yet the true commercial test, which involves the operation of a plant over a long period, selling its products in the open market and producing actual profits to the shareholders, is wanting. "To what degree low-temperature carbonization may develop as a real factor in national fuel utilization, time only can tell."

High-Temperature Carbonization and Smokeless Fuel.

In considering the question as to whether the gas industry is in the position to supply a solid smokeless fuel for domestic purposes, it may be well to re-state the requirements. The fuel must be easily ignitable, free burning, reasonably low in ash and moisture, of suitable size, and no more expensive than good house coal. These characteristics depend upon due attention being paid to a number of quite separate factors.

1. *Ease of Ignition* and free burning properties depend upon the process of carbonization, including such subjects as blending of coals, temperature of carbonization, rate of carbonization, type of carbonizing plant.
2. *Ash Content* depends upon the purchase of suitable coals, or the cleaning of coals prior to carbonization.
3. *Moisture Content* depends upon the care employed in the method of quenching.
4. *Price* depends upon the process employed, the local conditions of coal value, and other similar factors.
5. *Correct Sizing* depends upon the knowledge of the sizes suitable for various requirements, and upon seeing that the consumer gets these sizes.

Modified Process of Production Not Enough.

The present writers have ventured to put down the above somewhat obvious statements because there is too great a tendency to regard a modification in *process* as being all that is necessary to improve coke quality. A low-temperature fuel with a high ash content and with an excessive moisture content is no improvement over a good gas-works coke made from a low ash coal with proper quenching. It is probably not overstating the case to say that there is a wider difference between the best gas-works coke and the worst gas-works coke sold at the present day than there is between the high and the low temperature carbonization products. The World Fuel Conference clearly pointed to the fact that, if the gas industry concentrates as much attention on the improvement of coke production methods as it has paid to gas production methods, then there is no reason why it should not supply all the national needs in the form of domestic and industrial solid smokeless fuel without adversely affecting its commercial results.

The Effect of Blending.

The need for the blending of coals prior to carbonization, in order to improve coke quality, is evidently being

faced all over the world. M. Berthelot, dealing with France, in his paper (W.3), states that in many cases the blending of suitable caking and non-caking coals prior to carbonization, especially if they be cleaned coals, leads to improved coke quality. W. H. Blauvelt, discussing American carbonization practice, in his paper (H.10) states that the general practice of mixing two or more kinds of coal has greatly improved the quality of coke. Many of the purest American coals, when coked alone, do not produce a coke of a satisfactory nature, but when suitably blended yield first-class cokes. In Japan, according to Y. Oshima (H.11), the use of Japanese coal for the production of coke has only been made possible by the development of the Shimonura process in which the coal is blended with a semi-coke made at 400° to 600° C. in a previous subsidiary process.

Blending in Great Britain.

In Great Britain the blending of coals is probably carried out at the present day to a less extent than in America, France, or Germany. The great significance which these countries assign to coal blending is one of the lessons of the conference to this country. Whatever may be the extent of our large-scale application of blending, there can be no doubt that, as regards scientific knowledge on the subject, Great Britain stands second to none. An example of this knowledge was to be found in the paper by Dr. J. G. King on the "Fundamentals of Coal Blending and the Production of Solid Smokeless Domestic Fuel" (H.7).

Advantages of Blending.

The delegates to the World Fuel Conference were in general agreement concerning certain aspects of blending. It was agreed that the development of blending would considerably increase the range of coals suitable for coke production; that the resultant coke from a suitable blend is better than the coke from either of the individual coals; that the heat penetration of a charge of blended coal is improved, with consequent increase in output of a given plant and reduction in cost of operation. It was also the general opinion that blending involves the fine grinding of the coals. There is not quite such close agreement as to which of the constituents of the blend should be ground the finer. Dr. J. G. King is of the opinion that the strongest cokes are obtainable by fine grinding of both constituents, but that the diluting constituent may, if it is a suitable coal, be of larger particle size. When the diluent is coke, it must be finely divided. M. Berthelot considers that the constituent which plays the part of the inert matter should be ground more finely than the other.

Gas-Works Coke Can be Improved.

In discussing the production of domestic solid smokeless fuel, Dr. J. G. King comes to the important conclusion that, of the ten million tons of coke produced annually for sale by gas undertakings, a high proportion could, by known methods, be made suitable for domestic consumption without decreasing the gaseous thermal output of modern plant, and that the production of coke breeze of low value could be prevented. Such a procedure would go some distance towards replacing the forty million tons of raw coal consumed annually in domestic appliances.

"Homite."

Dr. King considers that the main feature in improving coke quality is the correct blending of coals to ensure the right distribution and behaviour of the "binder." Reference was made by him, and by other speakers during the discussion, to the large-scale experiments which had been carried out at Ramsgate in intermittent vertical chambers. This process—the "Homite" process—consists of suitably blending small coking and non-coking coals, carbonizing the blend in standard high-temperature chambers, and completing the carbonization in approximately two-thirds of the normal coking time. Such a process is of importance to gas undertakings because it involves no modification in carbonizing plant where static carbonization is employed. Gas output per day is maintained because of the increased rate of carbonization. Any coke breeze made can be incorporated in the blend. It is even questionable whether it is necessary to leave much residual volatile matter in the coke to ensure a free burning, easily ignitable fuel.

Effect of Volatile Matter on Ignition-Point of Coke.

In the course of the discussion on the products of the carbonization industry, Dr. J. G. King made a statement which, from the point of view of the gas industry, was one of the most important features of the whole Fuel Conference. Low-temperature carbonization processes have been largely built up on the idea of the necessity of leaving a portion of the original volatile matter in the residue in order to obtain an easily ignitable fuel. The gas industry, while accepting the need for improved coke quality, has been loth to part with any of the yield of gaseous therms.

An Important Experiment.

Gas coke has usually been regarded as less easily ignitable by reason of its lower volatile content; but now comes the publication of Dr. King's experiments. Coke was made at a relatively low temperature—600° C.—and was burned in an open grate. The component of horizontal radiation was determined as the measurement of heat given out. The same coke was re-heated in the same retort, in the absence of air, to 950° C., to remove volatile matter. It then ignited almost as easily as the original coke, but burned more slowly, and the fire lasted a longer period. The amount of volatile matter, therefore, does not seem to affect the coke, beyond making it rather slower burning.

This same view was held by Mr. J. Roberts, who, in describing work on his process, as carried out in the intermittent vertical chambers at Ramsgate, stated that prior to the experiments he had prescribed 3 to 8 p.ct. of residual volatile matter in the smokeless fuel, but as the result of the large-scale tests he had found that it was not necessary to have a residual volatile content above 3 to 5 p.ct. in order to have an easily ignitable domestic fuel.

A Fortunate Position.

The obvious lesson from these experiments is that it appears that the gas industry is in the fortunate position of being able to "have its cake and eat it." It can, by using clean coals, suitably blended, produce a first-class smokeless domestic fuel while yet retaining the major portion of the volatile therms which are so essential to its prosperity.

Comparative Performance of Various Fuels in the Open Grate.

Dr. Margaret Fishenden, in her paper (L.5), gave an interesting comparison of the relative behaviour of various fuels in the open grate. Gas coke, providing it does not contain too much moisture and ash, gives a higher radiation efficiency and a more uniform heating effect than raw coal in open grates. It is, however, somewhat difficult to light, and does not burn well unless the draught through the fire is high, the firebed deep, or the insulation of the grate effective. Low-temperature coke, by reason both of its structure and of its increased proportion of volatiles, is relatively easy to ignite. Dr. Fishenden has found that gas coke with a calorific value of 12,900 B.Th.U. gives, when nearly dry, radiation efficiencies of 24 p.ct. and 28·5 p.ct. respectively in two different types of ordinary grates, compared with 21 p.ct. and 24·5 p.ct. for a good house coal. Various samples of low-temperature cokes burning in different grates emitted radiation equivalent to 20 p.ct. to 34 p.ct. of their thermal value, as against 17½ p.ct. to 24½ p.ct. for coal.

Dr. J. G. King gives some interesting comparative data in his paper (H.7). He finds, as already stated, that, though residual volatile matter in coke has no marked effect on ignition temperature, a coke with a small amount of volatile matter burns up much more slowly and attains its maximum rate of radiation much later. This defect can, however, be overcome by suitable modification of the type of grate. Dr. King also shows that cokes made from a blend of coal and coke appear to give a more combustible fuel than coke made from a blend of two coals.

Is Ease of Ignition an Essential?

The advocates of low-temperature carbonization make a great point of the ease of ignition of their fuel; but

this point can be over-stressed. The object of a smokeless fuel is to eliminate all smoke. To light a smokeless fuel fire with paper and wood is definitely unscientific. It is during the combustion of the paper and wood at low temperatures that a considerable amount of smoke is formed. The scientific and smokeless way to light a smokeless fuel fire is by means of gas ignition. If this be accepted, then the need for an easily ignitable fuel disappears, because a less ignitable fuel can be satisfactorily lit by means of gas.

IMPROVED GRATES OR IMPROVED FUEL?

Again, there is, it is suggested, too great a tendency to aim at producing a fuel which will burn satisfactorily in the present design of open grates. While this may necessarily be a temporary expedient, should not greater attention be paid to the improvement in the design of grates, so that they will behave satisfactorily with a wider range of fuels? This same idea of blaming the fuel was mentioned in quite another connection at the conference when Mr. H. R. Ricardo stated, in discussing internal combustion engines, that there was too great a tendency for the engineer to shift the burden on to the shoulders of the chemist, and to demand of "doped" fuel what ought to have been provided for by the engine design.

IMPROVING COKE QUALITY BY THE ADDITION OF INORGANIC CONSTITUENTS.

Prof. J. W. Cobb, in his paper on gas manufacture (H.8), emphasized that low-temperature carbonization is not the only way of producing solid smokeless fuel of high chemical reactivity which will burn cheerfully. Interesting results have been obtained in making coke more reactive by the addition of inorganic constituents, such as sodium carbonate, oxide of iron, and lime. "No claim can be made that the use of such cokes has reached the stage of successful commercial application, but the possibilities are fascinating." The present authors suggest that this work is mainly of academic interest.

AN ECONOMIC PROBLEM.

It is not possible at the present stage to state which of the two methods of carbonization will supply the nation's needs of domestic smokeless fuel. From the technical standpoint there is no doubt that a satisfactory fuel can be produced either by high-temperature or by low-temperature processes. The problem is therefore ultimately an economic one. From this viewpoint the gas industry is in a favourable position. It is already well established with capital profitably employed, and it has a sales organization for gas and coke. The establishment of another carbonization industry engaged in the supply of domestic fuel cannot be to the national advantage—much less to the advantage of the gas industry—and the best way to counteract such a possibility is for the gas industry to concentrate every effort on the production of a domestic smokeless fuel at an economic price, so that the general public may turn to the gas industry for all smokeless domestic and industrial fuels.

THE GASEOUS THERMS OBTAINABLE BY CARBONIZATION.

A Simple Method of Laboratory Assay.

A ready laboratory method of assaying the gaseous yield of gas coals has recently been evolved by Dr. Geipert, the eminent gas chemist, of Berlin. We understand that it is proving useful to gas-works on the Continent, especially for the rapid comparison of one coal with another, or for assessing the value of an untried brand. The following description, contributed by the inventor to our contemporary, "Das Gas- und Wasserfach," will no doubt prove of interest.

INTRODUCTORY.

Coal is a mixture of hydrocarbons; it contains no free carbon. The nature of the combinations of the carbon with hydrogen and with the oxygen which is also present in the coal is still largely beyond our knowledge. It is true that the hydrocarbons can to a certain extent be separated by extraction from the coal; and further that elemental analysis gives the percentage of each individual element in the coal. The molecular dimensions of the combinations, however, remain undiscovered, as does the arrangement of the atoms in the molecule, and consequently any exact knowledge of these hydrocarbons. It can, therefore, never be foreseen just how any one coal is likely to behave under any particular treatment, especially under the influence of the processes which are employed for the production of coal gas, and which are known as dry distillation at high temperatures.

We only know that every coal can be carbonized. The carbonization is, however, not an object in itself, but merely the means of obtaining from the coal products of which the total value exceeds that of the crude coal sufficiently to cover the costs of the process. Otherwise the carbonization would be wasteful, and therefore senseless. But all coals which can be profitably carbonized do not yield products of the same nature or in equal quantities. In other words, their gaseous yields vary.

THE GASEOUS YIELDS OF GAS COALS.

To find out the gaseous yields of various coals, most big gas undertakings possess experimental installations containing two normal horizontal retorts, with as nearly as possible equal heating. In this way, of course, satisfactory results are obtained, but at considerable expenditure of both time and money. Hence it has long been the aim of gas-works chemists to reduce their tests to the scope of a laboratory experiment, and so to render practicable a rapid evaluation of any number of samples as they arrive. The author states that he has long worked on the problem, and has at last found a solution which satisfies him.

The course and results of the carbonization process depend, naturally, upon the conditions under which it takes place. The coal for distillation is introduced into an enclosed space, which is raised to glowing heat and is provided with only one outlet for the withdrawal of the gases and vapours produced. In practice this takes the well-known shape of retorts or chambers. In Dr. Geipert's apparatus it is a small-bore quartz tube. In the heated zone of a retort, dissociation of the coal takes place; gases and vapours are given off, and a solid residue of coke remains. With this primary splitting of the coal is associated, however, a secondary, and no less important, reaction. The primarily resultant gases and vapours do not entirely retain their original form, but are further dissociated under the influence of the heat of the process. As in the case of the coal itself, this secondary dissociation is to some extent proportional to the heat employed. It is, however, also partly dependent upon the length of time that the products remain in the heated zone, and on the dimensions of the heated surface to which they are exposed.

It is claimed that the apparatus and method evolved by the author conform with these conditions, and that therefore the same coal gives always the same results, and that the values obtained are a true indication of the performance of the coal in large-scale working.

DR. GEIPERT'S METHOD.

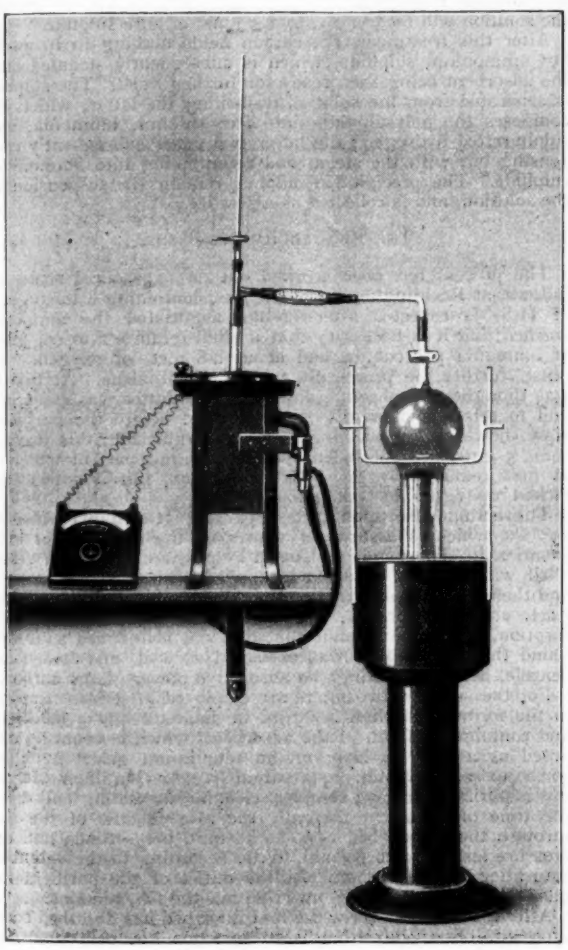
The method is shown by the illustration. The apparatus consists of an electric furnace, with the carbonizing tube inserted vertically into it. To the tube is attached a **T**-piece, through which the coal is introduced, and the products of carbonization withdrawn. To the horizontal arm of the **T**-piece is attached some means of cleaning the gas, which, in its simplest form, may consist in a tube tightly packed with glass wool. Beyond this is a graduated flask, with a water seal. To the side of the furnace can be seen the millivolt meter of a thermo-element, which permits of accurate control of the temperature within the furnace. The coal to be tested is "briquetted," and the miniature briquettes are always of the same shape and size. They therefore occupy always the same space, and, by the method by which they are introduced into it, they always leave empty exactly the same length of glowing quartz tube.

In the test, the tube is brought to a temperature of exactly 1100° C. The "tablets" of coal are weighed as nearly exactly as possible to 10 grammes, and suspended in the vertical portion of the **T**-piece. The whole apparatus—quartz tube, **T**-piece, purification tube, and graduated flask—is then connected up airtight; the flask being filled with water. The coal tablets are allowed to fall into the glowing quartz tube, and there is an immediate strong development of a brown-coloured

crude gas. This is, however, colourless when it reaches the flask; the tar vapours being retained in their entirety by the glass wool. According to the quality of the coal, the quantity of gas collected varies between 2700 and 3600 cc., equivalent to a make of 270 to 360 cub.m. per metric ton [9500 to 12,700 c.ft. per ton]. The gas make is easily read off on the graduated flask, and the reading is taken at the temperature of the sealing water, in which the flask is immersed before taking it. It is advisable to make the test three times, and to take an average, as there are bound to be small differences in the readings. The three tests occupy less than an hour altogether.

Calorific Value.

For further tests, some of the gas is drawn-off into another graduated bottle. Exactly measured quantities are passed from this to any desired calorimeter for the calorific value test. If the Junkers calorimeter be used, and suitably preheated with some other gas, then the combustion of 2 to 3 litres of the test gas will suffice to establish heat equilibrium, leaving quite enough for the calorimetric readings. The calorific values



found require correction by means of a constant, which must be once determined for each apparatus, and which depends upon the small amount of free space in the quartz tube and the purification tube. It amounts to some 2 p.ct. of the total calorific value. The remainder of the gas can be used for other analytical tests.

Coke make is represented by the solid residue in the quartz tube. The tar is collected in the glass wool, but, as only some 0·5 gramme is produced from 10 grammes of coal, data as to tar output are not very reliable. Variations by as much as ± 0·05 gramme were observed over a series of tests, though this corresponds to an error of approximately only 10 lbs. per ton.

Evaluation of Coals.

The evaluation of a coal from the results obtained can be worked out according to individual requirements. From the gas make and the calorific value, the gaseous therms are obtained, and these have a known monetary value. The value of the coke and tar can be added, to give a rough estimate of the value of the coal. Naturally, however, the percentages of ash and moisture must be taken into consideration, as well as the quality of the coke.

The method described, which is protected by German and British patents, requires for one complete test, including the calorific value of the gas and its nitrogen and carbon dioxide contents, barely two hours, or no longer than an ordinary coal analysis. By the distillation by this means of small samples, protection can be had with little trouble against inferior qualities of coal, and working efficiency thereby considerably improved.

AN INDEPENDENT ESTIMATE OF THE METHOD.

Dr. Geipert's method has recently been the subject of an investigation at the Karlsruhe Gas Institute—the experimental and research station of the German Gas Association—and Dr. Bunte and W. Zwieg reported upon it in "Das Gas- und Wasserfach," for June 30 last, and in most favourable terms. The usual methods of estimating the gaseous therms of coal, they consider, give values considerably below those obtained in actual working. Gas make and calorific value, as is well known, are influenced to a great extent by the degree of dissociation of the tar and the hydrocarbons, and this is largely dependent upon the temperature of the carbonization zone, upon the path which the crude gas has to follow in this superheating zone, and upon the speed at which gas development takes place. Their investigations showed that Dr. Geipert's method gives, on a laboratory scale, a combination of these factors corresponding very accurately with that which obtains in actual large-scale working. It is important, however, to work exactly to the rules laid down.

Some Tests and Results.

The Dessau Vertical Retort Company, who supply the apparatus in Germany, placed one at the disposal of the Gas Institute, with which exhaustive tests were carried out, mostly on coals which had also been tested in large-scale working. It was found that the same apparatus used by the same worker reproduced results which agreed excellently, as did the same instrument used by different assistants. The agreement in gas make and calorific value was enhanced when the importance was realized of using a coal sample weighing as nearly as possible the 10 grammes prescribed by Dr. Geipert. A further very exacting test was made with a sample of coal supplied by the Gas Institute, which was tested in the apparatus there, and simultaneously in two other apparatus at other places. The results obtained were:

—	Gas Make. Cub.m. per Kg.	Calorific Value. K.cal./m³.	Gaseous Calories. K.cal. per Kg. Coal.
No. I.	34·6	5500	1904
„ II.	34·5	5506	1898
„ III.	34·4	5520	1900

Of still greater interest were the results obtained (*a*) by Dr. Geipert's method in the Gas Institute Laboratory, as compared with (*b*) those given for the same coals in the Institute's test plant, and, in one case (*c*), in the horizontal chamber ovens of a gas-works.

Coal No.		Gas Make. Cub.m. per Kg.	Cal. Value. K.cal./m³.	Gaseous Calories. K.cal. per Kg. Coal.
I.	*a*	34·6	5390	1868
	b	35·9	5230	1878
II.	*a*	35·3	5272	1860
	b	37·1	4943	1835
III.	*a*	32·7	5620	1855
	b	34·8	5340	1858
IV.	*a*	34·3	5660	1949
	b	34·4	5365	1953
V.	*a*	34·6	5500	1904
	b	34·4	5500	1892
	c	36·1	5285	1909

Dr. Bunte emphasizes the importance of carrying out exactly the instructions which are delivered with the apparatus, as good results depend upon this. In the light of his experience, several of the most essential points are recapitulated in his article. He also calls attention to the fact that the results tabulated above were obtained with dry coal. He has not succeeded in obtaining the same good agreement with washed gas coals or coking smalls, which, in actual working, as opposed to laboratory scale, are carbonized with a water content up to 10 p.ct. As is well known, with coals of this kind the tar vapours are carried so rapidly from the retort by the high water vapour content of the gas that they are subjected to a much smaller extent than usual to the cracking process.

PURIFICATION BY ACTIVATED CARBON AND RECOVERY OF SULPHUR IN THE SOLID FORM.

AN INSTALLATION AT RECKLINGHAUSEN.

[From the 1928 Report of the Committee on Gas Manufacture of the Association Technique.]

The Bayer Company, who had long employed wood charcoal for the recovery of various solvents, were among the first to manufacture activated carbon, and carried out with it experiments in debenzolization at their small works at Leverkusen; and having made a success of the process there, they installed it on a commercial scale at the Auguste Victoria Coke Works. When the Interessan Gemeinschaft (the Dyestuffs Trust) was founded, these coke works were selected as the experimental station, and were specially equipped for the investigation of carbonization problems; and the very plant which was used for the benzole recovery research served to bring to fruition the removal of sulphur from town gas by activated carbon. The plant, however, by continual modification, had become unduly complicated; and a much larger and better installation has been built at Leuna. Notes on both are given later.

THEORETICAL CONSIDERATIONS.

Sulphuretted hydrogen, no less than other gases or vapours, is susceptible, even when in low concentration in a gaseous mixture, to adsorption by activated carbon. Thus the latter, when in contact with gas containing no more than 6 gms. of H_2S per cub.m., is capable of taking up 2 p.ct. of its own (the carbon's) weight of that constituent. The absorptive power, which is relatively low at ordinary temperature and pressure, may be considerably enhanced by subjecting the gas to high pressure and cooling it; but such steps would be so complex and expensive as to prohibit their use in industry.

Dr. Engelhardt, of the I.G., who had in hand the research, conceived the idea of using the activated carbon not only as an adsorbent, but also as a catalyst for reaction purposes; and he added to the gas passing through the vessels a certain proportion of air, with a view to precipitating the sulphur by oxidation according to the formula

$$2H_2S + O_2 = 2H_2O + 2S + 107 \text{ cal.}$$

The reaction was, however, exceedingly slow at ordinary temperatures. It could, of course, have been accelerated by raising the temperature or by admitting an excess of air; but this would have introduced the risk of fire, and was, besides, hardly to the point.

He then contemplated employing sulphurous acid in place of oxygen for separation of the sulphur according to the formula—

$$2H_2S + SO_2 = 2H_2O + 3S + 37{\cdot}7 \text{ cal.}$$

In the presence of activated carbon this reaction is complete so long as the SO_2 added is equivalent to the actual H_2S present. But the latter varies so much in the course of gas production that the exact proportioning of the SO_2 becomes a very delicate operation; and on the other hand the removal of an excess presents serious complications. This solution of the problem was therefore also discarded.

AMMONIA AS CATALYST.

Dr. Engelhardt then returned to his original idea of using air as the oxidizing agent; but he sought to increase the rapidity of the reaction at ordinary temperatures by means of a catalyst. Numerous experiments with metallic agents were unsatisfactory; and finally it was realized that the object of the research was already to be found in practically any gas resulting from the carbonization of coal—namely, the ammonia. The simple molecular combination of sulphuretted hydrogen and ammonia is, of course, ammonium hydrosulphide ($NH_3 + H_2S = NH_4SH$); but the latter is readily oxidized, first to ammonium sulphide, then the bisulphide, and finally to the thiosulphate or hyposulphite $(NH_4)_2S_2O_3$. Primary consideration of these reactions does not indicate in any way that, from hydrogen sulphide and ammonia, one can obtain free sulphur; but nevertheless experiment showed that, by using activated carbon as catalyst, free sulphur was yielded—the thiosulphate and other compounds being formed in negligible quantities. The reaction might be thought to be—

$$2NH_4SH + O_2 = 2NH_3 + 2H_2O + 2S.$$

But this explanation fails when it is remembered that theoretically much less ammonia is required than is therein indicated. Indeed, for the precipitation of the sulphur from a gas containing only 10 to 12 gms. of H_2S per cub.m., the addition of 0·3 to 0·5 gm. of ammonia per cub.m. is more than enough. Thus the part played by the ammonia in the presence of activated carbon still remains somewhat obscure.

RECOVERY OF THE SULPHUR.

The carbon having been saturated, it is necessary to recover the sulphur and revivify the adsorbent. Different methods were tried; and the one which gave the best results consisted in extraction by means of a solution of ammonium sulphide. The saturated carbon is treated at moderate temperature with a solution obtained in the first instance by mixing commercial ammonium sulphide and 20 p.ct. strength "volatile alkali" in such quantities that the mixture contains per litre 70 to 80 gms. of the former and 130 to 150 gms. of ammonia. The sulphur dissolved from the carbon transforms the liquor into polysulphide form—*i.e.*, $(NH_4)_2S_3$ and $(NH_4)_2S_4$. One litre of the solution will recover 200 to 225 gms. of pure sulphur.

After this treatment, the carbon holds nothing in its pores but ammonium sulphide, which is subsequently steamed out; the adsorbent being then ready for further work. The sulphur is separated from the solution by boiling the latter, which decomposes the polysulphides into free sulphur, ammonia, and sulphuretted hydrogen; the latter two gases subsequently condensing out with the steam and recombining into ammonium sulphide. The precipitated sulphur remains in suspension in the solution, and is collected as a powder.

THE RECKLINGHAUSEN PLANT.

The process has been worked out on a practical scale, as follows, at Recklinghausen. The gas, containing 8 to 10 gms. of H_2S, is collected after it has negotiated the ammonia washer; but it is necessary that it shall retain 0·2 to 0·4 gms. of ammonia per cub.m. and about 0·8 p.ct. of oxygen. It must, further, be practically free of naphthalene. At first it was thought that absolute absence of the latter was essential; and to this end a pre-filter was inserted before the purifiers. Now, however, oil washing is deemed sufficient; this leaving some 5 gms. of naphthalene per 100 cub.m., part of which is at first removed by the activated carbon, but is afterwards picked up again by the gas.

The actual adsorption is best effected at a temperature of 35° C., which is assured in winter by the employment of a steam coil. The gas is moistened by passage through a vessel filled with wooden grids and supplied with steam or water; and thence it passes, warm and moist, to the carbon chambers. Early attempts were made to remove the benzole, also by adsorption, before the sulphur; but this was abandoned as it was found that the sulphur was extracted as well, and fouled the benzole, besides lowering the adsorptive power of the carbon.

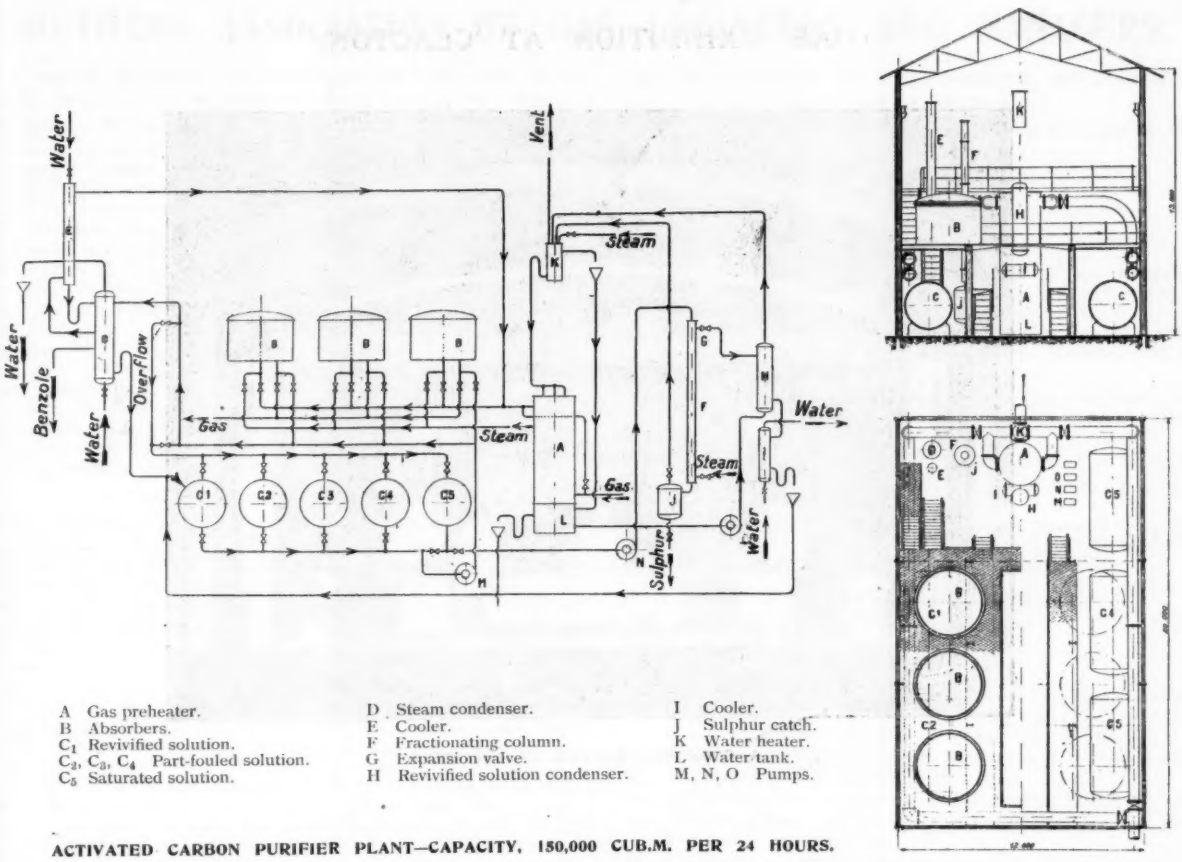
For the sulphur, two filters are employed in series. Each is in the form of a cylinder 2·9 in. in diameter and 3 in. high, and contains 5 cub.m. of the adsorbent, which is centrally disposed as a 0·75 m. layer on an aluminium grid. Actually, 30,000 to 40,000 cub.m. (approximately 1 to 1½ million c.ft.) of gas is purified per day; complete cleaning depending only upon the time of contact. Actually the rate of flow of the gas through the carbon bed is 60 to 70 mm. per second; and the pressure loss is 50 to 60 mm. W.G. according to the extent of saturation of the carbon. At the outlet of the purifiers the gas is substantially free from H_2S; but the CS_2 remains.

After 4 to 6 days' work, the first filter bed has absorbed some 1500 kg. of sulphur—that is to say, 300 kg. per cub.m. of carbon. As a matter of fact, the capacity is much greater than this; but it was found best to cut-out the vessel well before fouling of the gas is observable. The second filter then carries on alone while the first is regenerated, which process is easily completed in 8 to 10 hours.

THE RECOVERY PROCESS.

Revivification is effected as follows. The ammonium sulphide solution, of which the composition is given above, is run-off from a storage tank into the carbon container in such a quantity as completely to soak the material. After 30 to 60 minutes the sulphur is dissolved, and the polysulphide solution is pumped back to the tank. The washing is repeated with liquor from three other tanks containing successively less sulphur. This leaves the carbon clear of free sulphur but impregnated with sulphide liquor, which is removed by steaming the bed at 100° C.; the steam, carrying ammonia and sulphuretted hydrogen, being subsequently condensed in a condenser scrubber.

After several cycles, the liquor in the first tank is saturated, containing 200 to 225 kg. of sulphur per cub.m.; and it is pumped out to a tank whence it flows to a still, negotiating *en route* a gauze filter which intercepts fragments of carbon and other impurities. In the still, the solution is treated with



ACTIVATED CARBON PURIFIER PLANT—CAPACITY, 150,000 CUB.M. PER 24 HOURS.

saturated steam (pressure 1·5 to 2 kg. at 115° C.) admitted through four nozzles at varying depths; and no other stirring means has been found necessary. The steam, laden with hydrogen sulphide and ammonia, is treated in a condenser-scrubber, which results in ammonium sulphide; while the free sulphur is deposited in the truncated base of the still, and is finally centrifuged. The sulphur mother-liquor is used in the scrubber which treats the steam coming away from the carbon during regeneration and from the still.

Treatment of the polysulphide solution takes some 6 hours; and the consumption of steam during the whole cycle of operations amounts to 5 or 6 kg. per kg. of sulphur produced. The cyanides, equivalent to (say) 1 gm. of HCN per cub.m. of gas, are found in the carbon as 0·6 to 0·8 gm. of ammonium sulphocyanide, and reappear in the liquor, so that all the ammonia in the crude gas is recovered. Of the sulphur, about 95 p.ct. is recovered, for the remainder goes to form the sulphocyanides and sulphates.

The carbon used is made from lignite coke activated by steam at 900° C. Its apparent density is 0·35; and commercially it is known as "F quality," of which the price is only a tenth of that of the material employed for benzole recovery. The works engineers state that it becomes exhausted only very slowly, and that it will serve for more than 100 treatments before requiring revivification.

The sulphur obtained at Auguste Victoria is a granular powder of greyish yellow colour; the discoloration being due to traces of iron cyanides formed from contact with the various vessels. It has a content of 98 p.ct. sulphur and 2 p.ct. water and cyanides. It sells at Mk.10 per 100 kg., and is used for powder manufacture. At Leuna-Merseburg, on the other hand, the product (which is solidified) is practically a pure yellow, and highly acceptable commercially; and incidentally Auguste-Victoria claim that their product would be just as good if melted down, and are experimenting in that direction. It should be mentioned, however, that the Leuna installation deals only with water gas, which contains less cyanide and is purer as far as condensable hydrocarbons are concerned than coke oven gas. Possibly it is the hydrocarbons which cause the greyish discoloration, which undoubtedly lower the market value. The Leuna product fetches Mk.14 per 100 kg.

The Leuna Installation.

The purification plant at Leuna has no less than 40 filters in parallel, and is capable of dealing per day with 5 million cub.m. [over 176·5 million c.ft.] of water gas with a content of 3 gms. of sulphur per cub.m. The bed of carbon in each vessel is about 1·25 m. in depth; and the speed of travel of the gas therethrough is 80 mm. per second. It is pointed out that the capacity of the plant could be doubled by providing two adsorbent beds, negotiated in parallel, in each vessel. The installation has been brought to a much higher state of efficiency than that at Auguste-Victoria.

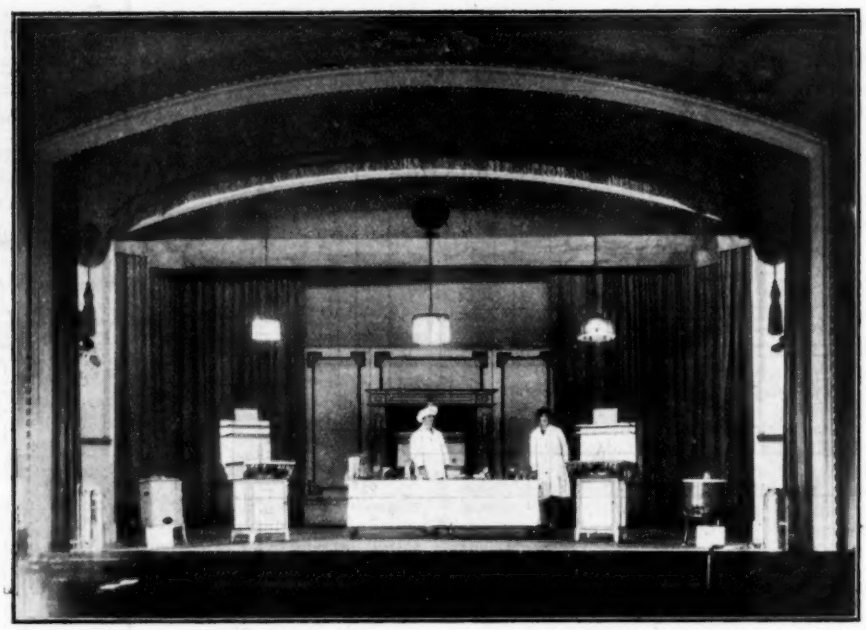
The accompanying drawing is of a modern plant (at Leuna) of a capacity of 150,000 cub.m. [over 5 million c.ft.] per day. The gas is warmed to about 35° C. and saturated with moisture in the scrubber A, which receives a spray of hot solution from the tank K; the latter being fed from the sulphur boiler J and an independent steam supply. The spraying liquid collects in the reservoir L, and is pumped back into K through condenser H. The greater part of the heat required for warming the gas is thus recovered in the polysulphide circuit. The excess liquor from L, which contains 60 to 80 p.ct. of the hydrocyanic acid of the gas, in the form of ammonium sulphocyanide, overflows into the ammoniacal liquor well. The gas leaving A passes from top to bottom a number of carbon containers B in parallel; of which each is periodically cut-out for revivification on the same lines as at Auguste-Victoria.

The carbon is methodically treated with progressively weaker solutions of ammonium sulphide from reservoirs C_4, C_3, C_2, C_1, from which it is pumped by M. Saturated solution is drawn-off into C_5. Foul carbon is washed with the contents of C, which are very low in sulphur, and the product is then steamed out of the carbon; the vapour passing to condensers D and E, and the surplus mixture of water and sulphur back to C_1. Small quantities of benzole are separated and recovered.

In order to supply the solid product, the Leuna plant has the following features over and above Auguste-Victoria. The concentrated solution from C_5 is fed continuously by pump N to the top of a fractionating column F into which steam is injected. In this, the polysulphides are dissociated into sulphur, ammonia, and hydrogen sulphide; the operation being carried out under a pressure of 1·5 to 2 kg. and at a temperature of 120° C. at the base of the column (the melting-point of sulphur is 114° C.). Thence the sulphur flows, together with any water which has not distilled but which contains sulphocyanides, into the reservoir J, from which it is extracted periodically; and the hot water, by reason of the pressure in F, rises from J into the hot solution tank K. Vapour from the column F expands in G, and is then led to condenser H, where it heats the water feeding K. Condensation of the ammonia and hydrogen sulphide is completed in I, whence the solution flows to reservoir C_1.

In conclusion, it is remarked that the space occupied by such an installation is only about one-fifth of that required by an oxide purification plant of similar capacity—and this without taking into account the area of a revivifying floor.

GAS EXHIBITION AT CLACTON.



A COOKERY LECTURE IN PROGRESS.

SOME OF THE EXHIBITS.

The Clacton Urban District Council Gas Department are to be congratulated upon the excellent Gas Exhibition just concluded in that town. This is the first venture of its kind that has been embarked upon since the Council purchased the local gas undertaking in 1899; and complete success has deservedly attended this initial effort. The organization of the exhibition, which was held in the Westcliff Gardens Theatre, was conducted by Mr. S. Francis, M.B.E., Gas and Water Engineer to the Council.

The Clacton Gas Department provide their consumers with gas at a favourable price; and with this initial advantage, added to a well-advertised and attractively-arranged exhibition, it is not surprising that keen interest and a good attendance were maintained throughout the whole period of the exhibition. Special interest centred round the cookery lectures and demonstrations given each afternoon and evening by Miss Helen Crawford-Fox; and a comprehensive display of gas cooking, heating, and water heating appliances by Fletcher, Russell, & Co., Ltd., and the Richmond Gas Stove & Meter Company, Ltd., also attracted considerable attention. This display included, among other appliances, Richmond's well-known "Bungalow New World" "Regulo" controlled cookers and ranges, "Period" and "Marlborough" fires, "Don" geysers, and "Lyn" boilers.

Conspicuous among the Fletcher Russell exhibits were their popular "Kingsway New World" "Regulo" controlled cookers, "Queensway New World" ranges, their "Historic" and "Crusader" series of fires, "Laurel" gas irons, &c.

This exhibition reflected sound staff-work on the part of the organizers, to whom every credit is due.

SOUTHERN ASSOCIATION OF GAS ENGINEERS AND MANAGERS.

A General Meeting of the Association was held at the Hotel Cecil, W.C. 2, on Wednesday, Nov. 14—Mr. C. VALON BENNETT, of Rochester (the President), in the chair.

The minutes of the previous meeting (as published in the "JOURNAL") were taken as read, and confirmed.

The PRESIDENT remarked that a number of apologies for absence had been received. He was particularly sorry to say that Mr. Thomas Hardie, the immediate Past-President, was not able to be with them, in consequence of his absence in America. Mr. Frank H. Jones had also written regretting inability to be present. Having said this, he would like to add how much as an Association they appreciated that one of their members—Mr. John Terrace—was President of the Institution of Gas Engineers, and that he had been good enough to join their meeting that day. He was sorry to have to refer to several deaths since their last meeting. In this connection, he mentioned Mr. J. S. Dougall, of Boston, Mr. Arthur F. Bezant, and Mr. Peter Robertson. To the two late Editors of the Technical Press the Association and the industry were greatly indebted.

The members showed their sympathy by standing silently.

ELECTION OF NEW PRESIDENT.

The PRESIDENT said it was now his pleasure to submit for approval the name of Mr. W. E. Dean, of Exmouth, as President for the year 1929. Mr. Dean was well known to everyone, and he (the President) felt sure he would do everything, not only to uphold the Association and its work, but to add to its prestige and usefulness. He had, as the members knew, been the Association's Vice-President, and had also been Chairman of the Western District Committee. These were both positions of responsibility and of training for the Presidential Chair. He had filled them with dignity, and the members would have much to congratulate themselves upon if he accepted the new office. The President then formally moved Mr. Dean's election.

Mr. P. G. G. MOON (Bournemouth), in seconding, said that in the Southern Association they had always been very careful to preserve their traditions, and he felt certain that in Mr. Dean a continuance of these excellent traditions would be ensured. One could tell a man by the company he kept, and in the same way it was possible to judge a gas engineer, at any rate to some extent, by the character of his works. Any of them who had had the privilege of visiting Mr. Dean's works would have found on every hand the clearest indications that the man in charge was one who loved his job. What the Association needed in their President was enthusiasm in and love of his work. In Mr. Dean they had the man.

Mr. W. E. DEAN (Exmouth), after the proposition had been carried by acclamation, said he was deeply sensible of the honour that had been bestowed upon him in electing him President of this old Association. He realized to the full what his responsibilities were; and though he represented what was comparatively a small undertaking in the West of England, he would do everything in his power to uphold the dignity of the Association. It had been his good fortune to serve under three Past-Presidents. He well remembered when the late Mr. W. H. H. Broadberry was President of the Association, and little did he dream then that the time would come when he himself would be elected to the position. Those of them who were in the West had had rather a lone furrow to plough. Nevertheless they worked hard. They had established a District Section down there the value of which was fully appreciated, and they were always pleased to join their Eastern Section colleagues in their deliberations. While feeling in the Western District that they were more or less away from the centre of things, they did their best to keep flying the flag of the industry. He would be pleased, during his term of office, if those who could make it convenient to come down to the West would do so, to show them something of what they called the "Jewel of Devon." His works were not large, but he endeavoured to keep them as efficient as possible.

THE NEW VICE-PRESIDENT.

Mr. DEAN said it was now his pleasure to propose Mr. Frank H. Jones, M.Inst.C.E., of London, as Vice-President of the Association for the year 1929. Mr. Jones's name was, of course, a household word in the industry. He was Vice-President of the South Metropolitan Gas Company, Chairman of the Wandsworth, Wimbledon, and Epsom District Gas Company, and Deputy-Chairman of the Eastbourne Gas Company. His recent selection as President of the British Commercial Gas Association was a clear indication of what the members of the gas industry thought of him.

Mr. C. H. RUTTER (Brighton) remarked that he regarded it as a privilege to be allowed to second the proposal. He had known Mr. Frank Jones for many years, and perhaps better than many of those present. For some time past, indeed, he had been in constant contact with him as one of the Directors of his own Company. They would certainly be doing right in electing Mr. Jones to the Vice-Presidency.

The proposition was heartily agreed to.

GENERAL COMMITTEE, DISTRICT COMMITTEES, AND DISTRICT EDUCATION COMMITTEES.

The HON. SECRETARY reported the following elections by the Districts:

EASTERN DISTRICT, 1929.

Chairman.—Mr. H. C. Smith.

Vice-Chairman.—Mr. T. Carmichael.

Hon. Secretary.—Mr. W. H. Warren.

Committee.—Messrs. A. H. Andrews, C. Valon Bennett, W. H. Bennett, D. C. Cross, H. Gage, L. G. Humphrys, S. Lacey, L. J. Langford, E. L. Nicholas, C. T. Price, R. H. Ruthven, C. H. Rutter, W. J. Sandeman, A. W. Sumner, J. Terrace, J. S. Thorman, L. Trewby, and J. Urquhart.

Ex-Officio Members of the Committee.—The President, the Vice-President, and the Honorary Secretary for the time being of the Association.

Representatives on the General Committee in place of those retiring by rotation.—Messrs. W. H. Bennett, H. Gage, and A. W. Sumner.

Representatives on the District Education Committee of the Institution of Gas Engineers.—Messrs. L. G. Humphrys, R. H. Ruthven, E. Scears, and L. Trewby.

WESTERN DISTRICT, 1929.

Chairman.—Mr. J. Taylor.

Vice-Chairman.—Mr. J. Armstrong.

Hon. Secretary.—Mr. J. B. Cattle.

Committee.—Messrs. J. Hughes Cornish, C. G. Dawson, S. E. Halliwell, C. Harris, H. Higham, P. S. Hoyte, J. H. Lowther, J. Harger Pye, H. E. Riley, C. Stapleton, A. Thomas, H. W. Versey, E. P. Vince, W. N. Westlake, and J. Wesley Whimster.

Ex-Officio Members of the Committee.—The President, the Vice-President, and the Honorary Secretary for the time being of the Association.

Representative on the General Committee in place of member retiring by rotation.—Mr. J. Hughes Cornish.

Representatives on the District Education Committee of the Institution of Gas Engineers.—Messrs. C. Harris, R. Robertson, J. Taylor, and W. N. Westlake.

ELECTION OF HON. AUDITORS.

On the motion of Mr. P. S. HOYTE (Plymouth), seconded by Dr. H. G. COLMAN (London), Messrs. James Donaldson and John Urquhart were elected Hon. Auditors.

THE SECRETARYSHIP.

The PRESIDENT, proposing the re-election of Mr. H. C. Smith, of Tottenham, as Hon. Secretary, remarked that Mr. Smith had intimated to the Committee that morning that, while he was willing to undertake the work for 1929, after that it would be necessary for someone else to take his place. They were very sorry to hear Mr. Smith's resolve, but he was insistent upon it. He (the President) felt he would like to take this opportunity of moving a vote of thanks to Mr. Smith for his past services. Those who occupied the chair realized the great value of the Secretary's assistance to an Association of that kind. Mr. Smith had never spared himself in their interests, and he could only say how glad he was that no change in the Secretaryship had taken place during his own year of office. When the time came to part with Mr. Smith they would miss him very much.

Mr. T. CARMICHAEL (Portsmouth), in seconding, said that, as a member of the Committee, he sincerely hoped Mr. Smith would reconsider his decision at the end of the next twelve months. ["Hear, hear."] The Association could not have a better Secretary. Mr. Smith was as efficient as he was popular.

Mr. H. C. SMITH, returning thanks, said it had been a great pleasure to work with Mr. Valon Bennett, as all who knew him well would understand. Nothing could possibly be too much trouble when one's efforts were so fully appreciated. He would be very sorry to give up his position as Secretary, but he had debated with himself whether it would be fair for him to keep it on any longer, and had reluctantly come to the conclusion that he ought not to do so. Really most of the work attaching to the position of Secretary had been done by his clerk, Mr. Tracey.

NEW MEMBERS.

On the proposition of the PRESIDENT, the following new members were elected:

Mr. Frank Blackburn, Engineer in charge of the Devonport Gas-Works.

Mr. Robert John Hinton Clark, Engineer to the Plymouth Gas Company.

PRESENTATION OF CERTIFICATES.

The PRESIDENT then presented certificates to the following successful candidates in the Higher Grade Examinations in

Gas Engineering and Gas Supply of the Institution of Gas Engineers:

Gas Engineering.

Mr. J. Kirkhope	London	First Class
Mr. W. L. Ashman	Bath	Second Class
Mr. C. Deas	Cheshunt	,, ,,
Mr. H. C. Feltham	Bath	,, ,,
Mr. N. G. Ibbett	London	,, ,,
Mr. F. Lowe	Ramsgate	,, ,,
Mr. T. McSweeney	London	,, ,,
Mr. H. D. V. Millett	Portsmouth	,, ,,
Mr. R. J. Pepper	London	,, ,,
Mr. J. W. Pye	Plymouth	,, ,,
Mr. H. Risby	London	,, ,,
Mr. E. Sharman	London	,, ,,
Mr. B. Stonham	Tunbridge Wells	,, ,,
Mr. N. F. D. Wardle	Bath	,, ,,

Gas Supply.

Mr. S. F. Baker	London	Second Class
Mr. H. Craton	London	,, ,,
Mr. C. G. Osborne	London	,, ,,
Mr. A. G. Phillips	London	,, ,,

ISOLATION OR FUSION: THE PROBLEM OF THE SMALL WORKS.

Mr. W. W. TOWNSEND (Colchester) then read a paper on "Isolation or Fusion: The Problem of the Small Works." This, with the report of the discussion to which it gave rise, is given below.

The PRESIDENT said they had listened to a delightful paper and an excellent discussion. He proposed a hearty vote of thanks to Mr. Townsend.

Mr. R. H. RUTHVEN (Ramsgate), seconding, remarked upon the fact that the small undertakings had had a "good innings" that afternoon.

VOTE OF THANKS TO THE PRESIDENT.

Mr. F. LIVESEY (Maidstone) proposed a vote of thanks to the President for the able way in which he had conducted the business of the Association, and expressed the grateful appreciation of the members for all he had done for them. He made reference to the enjoyable visit to Rochester last May.

Mr. J. TAYLOR (Weston-super-Mare), who seconded the motion, declared that Mr. Valon Bennett had made an excellent President, and they were all indebted to him.

The PRESIDENT said the words of the mover and seconder of the vote of thanks, and the manner in which the members had received the proposition, touched him deeply. He believed his year of office expired on Dec. 31; but as he did not expect to have the honour of presiding over another meeting before that day, he felt somewhat sad that the time had virtually arrived when he had to hand over the reins of office to his successor. He said he was sorry, because he had enjoyed his Presidential year. He had received every assistance from the Committee and officers, and without that help he was sure he would have done really badly. He had no doubt that his predecessors in the chair, when elected, felt as he did, that they were proud of the knowledge that their colleagues had thought fit to bestow upon them the highest honour which the members had to confer. If he had maintained, as he had tried to do, the traditions of the Association, and his work had met with approval, he was thankful. Before resuming his seat, Mr. Bennett expressed his thanks to the Chairman and Directors of the Rochester Gas Company for their assistance during his year of office. They had shown unbounded enthusiasm; and for this and many other things he was grateful.

ISOLATION OR FUSION: THE PROBLEM OF THE SMALL WORKS.

By W. W. TOWNSEND, of Colchester.

[A Paper before the Southern Association of Gas Engineers and Managers, Nov. 14.]

In considering the question of amalgamation, it seems to be the general opinion that the natural and inevitable result of such a policy will be to concentrate the manufacture in the best situated and best equipped works, and to close down the others, which would be supplied by means of high-pressure transmission lines. No doubt there are cases in which such a policy is well justified—as, for example, where the central station is situate on the seaboard, and can thus obtain its coal at a much lower price than inland towns distant only a few miles. On the other hand, as is well known among gas engineers, mere size in a gas-works above a certain limit does not affect materially cost of production, in which respect, and in the fact that all gas-works are provided with storage, they differ entirely and fundamentally from electric power stations. There is, however, a limit of size below which mechanical aids to cheaper production cannot profitably be employed; and they are works which still depend on manual labour for their operations. They are referred to throughout this paper as "small" works.

During the past few years a good deal of attention has been given to the topic of amalgamation; and it seems opportune to examine the matter in some detail with the object of clearing away some of the misconceptions which appear to be prevalent, and of viewing it impartially as a problem of great importance to the welfare of the gas industry. At the outset the writer admits that his experience is limited, and he makes no claim to special knowledge of the subject; the principal object of this paper being to arouse a discussion. It may be as well to state further that the views expressed are personal and are, no doubt, open to criticism, which it is hoped will be freely expressed.

In considering the subject, it may be conveniently divided into sections, on the following lines:

(1) Intensified competition from electricity.

(2) Amalgamation or joint working of gas undertakings—

(*a*) Supply of gas from the larger works, and the closing-down of small works.

(*b*) As an alternative to (*a*), improving the efficiency of small works.

(*c*) The group system.

(1) INTENSIFIED COMPETITION.

Since the passing of the Electricity Supply Act, many prophecies have been made as to the effect of the electrification of the countryside. In July last, the report of the proceedings of the conference on electric supply in rural areas, convened by the Electricity Commissioners, was issued as a Blue Book; and no doubt the members are familiar with the conclusions, which are worthy of study. One quotation may be made:

> It is evident that, for economic reasons, rural electrification cannot be proceeded with to the extent of placing a supply of electricity at the service of every inhabitant, farm, and other premises throughout rural Britain. There is no doubt that the prospects in the sparsest and most remote areas are of such a low order as to preclude, or at any rate to delay, for many years to come, the establishment of a public supply on a remunerative basis. It has been variously estimated that up to 50 p.ct. of the more sparsely populated rural portions of the country is likely to fall within this category.

The writer is able to give some information about a scheme of electricity supply to a rural area, which provides an illuminating commentary on the report above mentioned.

In the year 1921, the City of Hereford Electricity Department, having surplus generating plant at their disposal, embarked on a scheme of supply to a large rural area surrounding the city. The following figures, taken from the last published accounts, reveal the fact that the scheme has resulted in a huge financial loss.

RURAL SUPPLY SCHEME.

	£ s. d.
Capital expenditure to March 25, 1928	114,441 6 4
Year ended March 31, 1928:	
Sale of current and meter rents	10,085 15 9
Sundries	8 1 0
Total income	£10,093 16 9
	£ s. d.
Generation costs, proportion	5,640 0 0
Repairs and maintenance	849 15 2
Salaries, wayleaves, &c.	427 11 9
	6,917 6 11
Capital charges	8,990 10 9
	£15,907 17 8
	£ s. d.
Balance, being loss on year	5,814 0 11
Less second instalment of relief towards development fund loan from H.M. Treasury	2,500 0 0
Net loss	£3,314 0 11
	£ s. d.
Balance brought forward, accumulated deficit at March 25, 1927	33,757 4 5
Excess of expenditure over income for the year	3,314 0 11
Total to March, 1928—excess of expenditure over income	£37,071 5 4

BALANCE-SHEET (Revenue).

Dr. *Liabilities.*	£	s.	d.
Sundry creditors, generation costs, &c.	22,974	9	5
Loan charges, due to city account	16,935	13	9
	39,910	3	2
Banking account, due to City Treasurer	4,868	4	5
	£44,778	7	7

Cr. *Assets.*	£	s.	d.
Sundry debtors	2,707	2	3
H.M. Treasury—amount due in respect of grant towards development fund loans	5,000	0	0
Revenue account—balance	37,071	5	4
	£44,778	7	7

Average price per unit sold	1·8d.
Units sold	1,289,173
Number of consumers	237

All the figures given above relate to the rural supply only.

The sales of current in the city area were 3,575,211; the average price per unit, for the undertaking as a whole, was 1·70d., and the generating cost was 0·74d. Maximum demand, 2350 KW.; load factor, 29·98 p.ct. over the year.

The severe storms during last winter were responsible for considerable damage to the overhead lines in the rural area.

Attention is drawn to the fact that no less a sum than £114,441 has been expended in capital to secure 237 consumers.

The area supplied includes parts of the County of Herefordshire.

Total units generated for the whole undertaking	6,189,860
,, sold ,, ,, ,,	4,864,384
Used and unaccounted for	1,325,476
	= 21 p.ct.

The fact that the City Electricity Undertaking shows a credit balance of £32,788 19s. 9d. on its revenue account, while the rural scheme shows a debit balance of £37,071 5s. 4d., clearly indicates that for many years the rural scheme has been a drag on the city finances, and the price of electricity to the citizens has been necessarily maintained at a high figure in order to make good the loss incurred by the rural scheme.

Many useful lessons may be learned from this example. The first is that the business of electricity supply is subject to the ordinary laws of economics. This would appear to be obvious, but we have repeated evidence that it is not. The second (which applies with greater force to gas distribution) is the high cost of transmission lines. The third is that no municipality is entitled to risk the money of its ratepayers in speculative schemes outside its area for the benefit of people who are not ratepayers. The fourth is that there is obviously no great attraction to consumers in a rural area in a plentiful supply of electricity (note the small number of consumers) and the fact that there is a limit to the price they will pay, otherwise they could have been charged enough to make the accounts balance. The accounts show that, as a matter of fact, the income from sales of current and meter rents amounted to 1·8d. per unit. The fifth is that Local Authorities should be compelled to follow the praiseworthy example of Hereford, and to keep separate accounts for the outside areas.

The following quotation from a paper on "Electricity in New Zealand," by F. T. M. Kissel, is of interest:

> Greater caution has been observed during the past four years in the extension of transmission lines into rural areas, and a load of 0·2 H.P. *per capita* is adhered to as a general basis of design for the New Zealand system.

(2) AMALGAMATION OR JOINT WORKING.

The gas industry has by long tradition become accustomed to consider its problems not only from the point of view of the engineer, but also from those of the administrator and financier; and its present strong position is largely due to the fact that the gas engineer has been trained to yoke financial caution with technical enthusiasm. Those responsible for the present prosperity of the industry are not likely to be led astray by people who would apparently like to see an imitation of the electrical grid in the form of a network of high-pressure gas mains all over the country. One writer recently stated his opinion that three-quarters of the gas-works in the country should be shut down. Another avers that small gas-works are inefficient, and their supply poor, and the sooner they are taken over by larger undertakings, the better for them and the better for the industry at large. No doubt there are many cases in which it would be economical and advantageous for a large works to take over smaller neighbours, and to supply them with gas; but each case must be considered on its merits, and hasty generalizations should be avoided.

The writer has taken as an example a group of five undertakings, and has analyzed their working costs and estimated the cost of supplying the whole of them from the largest and best equipped by means of high-pressure mains, delivering into the existing holders at each works. The size of main required and the costs have been calculated from Mr. Stephen Lacey's papers given to the Institution of Gas Engineers in 1923 and 1928; and the writer wishes to express his obligation to Mr. Lacey for his invaluable work.

Works A is centrally situated in such a position that one main to the north would supply Works C at a distance of 10 miles, and Works B at a further distance of 12 miles; the total distance from A to B being 22 miles. Another main to the south would supply the other three works, the distances being:

A to D	10 miles
D ,, E	3 ,,
E ,, F	7 ,,
Total distance A ,, F	20 ,,

Allowing for constant pumping for 20 hours per day during the maximum day, the following quantities of gas would require to be pumped:

C	2,500 c.ft. per hour
B	12,500 ,, ,,
D	4,500 ,, ,,
E	5,500 ,, ,,
F	6,500 ,, ,,

Most economical size of main:

A to C and B	4 in.
A to D and E	4 ,,
E to F	3 ,,

Gauge pressure required	33 lb. per sq. in. for C and B
,, ,, ,,	34 ,, ,, ,, D, E, and F

COSTS.

	£
35 miles of 4 in. main at 11s. per yard, £968 per mile	33,880
7 miles of 3 in. main at 8s. 6d. per yard, £748 per mile	5,236
	£39,116

The costs taken from Mr. Lacey's paper, for cast-iron pipes, were as follows:

Diameter.	Cost of Pipes per Yard.	Laying per Yard.	Reinstatement per Yard.	Total per Yard.
	s. d.	s. d.	s. d.	s. d.
3 in.	3 4	5 2	4 0	12 6
4 ,,	4 4	6 8	4 0	15 0

The present cost of steel pipes is approximately the same as the cast-iron, and the cost of laying is less owing to the longer lengths and possibility of laying nearer the surface.

The writer's recent experience in mainlaying confirms Mr. Lacey's figures of cost, but 4s. per yard for reinstatement allows for repairing macadam road with tarred surface. In the case of a road surfaced with two inches of bituminous material, the cost of reinstatement, including concrete foundation, is 12s. 6d. per lineal yard of main.

In the case under consideration, the route would be along main roads, and the footpath is already occupied by telephone conduits; but it has been assumed that the mains could, for the most part, be laid in the grass verge at the side of the road; and on that basis the inclusive costs of laying steel mains, ineluding reinstatement of surface, have been taken as 8s. 6d. per yard for 3-in. main, and 11s. per yard for 4-in. main. The annual charges on the cost of the mains, including repairs, interest, and depreciation at 8 p.ct., would amount to £3128.

The quantity of gas to be pumped is 32,000 c.ft. per hour, requiring (say) 90 H.P., and the cost of the plant, allowing for duplicate compressors, would be about £1800, and the building £450; total, £2250. Allowing 15 p.ct. interest, maintenance, and depreciation, the annual cost in respect of the pumping plant would be £337, to which has to be added the running cost at ½d. per H.P.-hour for 4000 hours, or £750 per annum.

Summarizing the items, we have the following:

	£
Mains—interest, depreciation, repairs	3128
Compressors—interest, depreciation, repairs	337
Running cost—fuel, attendance, repairs	750
Annual costs	£4215

Gas sales at five outlying towns—B, C, D, E, F—535,000 therms.
Annual charges in connection with high-pressure scheme: 1·88d. per therm sold.

In considering the analyses of accounts alluded to, it must be remembered that the method of allocating the expenditure differs in almost every case. For example, in Works A the whole cost of engineers' salaries is debited to manufacture of gas, whereas in the other works the greater part of the salaries of the managerial staff appears under the head of management. In some cases, repairs of stoves, meters, and fittings are grouped together under one heading; in others, they are shown separately.

It will be noted that, in arriving at the net cost of gas, receipts from hire of meters, stoves, and fittings have been deducted. In arriving at the price to be charged for gas, this appears to be the correct method, as there are charges to be met for repair of meters, stoves, and fittings; and the amount received for hire should be credited in order to work out the price to be charged for gas only. It should be added that the

Analyses of Accounts of Six Separate Gas Companies.

Per Therm Sold.

—	A. Half-year, June, 1928.		B. Half-year, June, 1928.		C. Year to June, 1928.		D. Year to June, 1928.		E. Half-year, June, 1928.		F. Year, 1927.	
	d.	d.	d.	d.	d.	d.	d.	d.	d.	d.	d.	d.
MANUFACTURE—												
Coal and oil and coke	..	5·03	..	5·56	..	6·70	..	6·47	..	5·42	..	6·57
Less residuals—												
Coke and breeze	2·33	..	2·30	..	2·02	..	1·41	..	1·82	..	2·31	..
Tar	0·90	..	0·76	..	0·92	..	0·71	..	0·85	..	0·96	..
Sulphate	0·02	3·25	0·01	3·07	..	2·94	..	2·12	..	2·67	..	3·27
Net coal and oil		1·78		2·49		3·76		4·35		2·75		3·30
Purifying	..	0·06	..	0·06	..	0·01	..	0·07	..	0·13	..	0·04
Salaries	..	0·27	..	0·16	..	..	..	..	..	0·12	..	..
Wages	..	0·71	..	1·52	..	2·10	..	2·20	..	1·47	..	2·51
Repairs of works	..	2·37	..	3·02	..	2·0	..	1·89	..	4·28	..	1·75
Total works costs		5·19		7·25		7·87		8·51		8·75		7·60
DISTRIBUTION—												
Repairs—mains, meters, stoves, &c.	..	2·37	..	2·30	..	2·34	..	3·44	..	3·50	..	2·11
Rents, rates, and taxes	..	0·62	..	1·13	..	0·99	..	0·75	..	1·12	..	0·51
MANAGEMENT—												
Directors' fees	0·10	..	0·30	..	0·18	..	..	..	0·20	..	0·20	..
Salaries	0·37	..	1·26	..	0·73	..	0·59	..	0·63	..	0·23	..
Collectors	0·17	..	..	..	..	..	..	..	..	..	..	..
Stationery	0·05	..	0·17	..	0·06	..	0·04	..	0·07	..	0·09	..
General charges	0·11	..	0·32	..	0·17	..	0·16	..	0·16	..	0·19	..
Auditors	0·01	..	..	..	0·04	..	0·02	..	0·09	..	0·04	..
Management costs		0·81		2·05		1·18		0·81		1·15		0·75
Pensions and other charges		0·32		..		..		..		..		..
Expenditure, *less* residuals		9·31		12·73		12·38		13·51		14·52		10·97
Less rental—meters, stoves, and fittings		1·79		1·55		0·83		1·0		1·90		1·31
Net cost of gas		7·52		11·18		11·55		12·51		12·62		9·66
Revenue for gas only		9·82		16·53		15·26		15·60		17·77		14·04
Gross profit		2·30		5·35		3·71		3·09		5·15		4·38
Capital charges		2·30		4·44		1·45		3·09		5·0		2·59
Therms sold per annum	1,392,590		194,346		68,145		85,000		98,676		89,000	
C.ft. per annum	..		43,188,000		12,390,000		17,000,000		21,928,000		18,736,000	
Calorific value	470		450		550		500		450		475	
Population	52,211		15,046		2,861		3,847		6,581		3,719	
Gas sold *per capita*	26 therms		12 therms		23 therms		22 therms		15 therms		23 therms	
Electric supply	Municipal		Municipal		None		None		Private Co.		None	

extra money received from prepayment meters to cover hire of fittings, cost of collection, &c., amounting to about 1s. per 1000 c.ft., has been treated as hire of fittings and has also been deducted in arriving at the net cost of gas delivered.

It will be noted that Works A, being equipped with labour-saving machinery, has a cost per therm for labour in manufacture less than half that of the smaller works, notwithstanding the higher wages paid; and, as might have been expected, the net cost of gas into holder is much smaller for this works than for any of the others.

It is not wise, however, to jump to the conclusion that Works A could profitably supply gas to the others. It has been calculated previously that the average cost of supplying the five small works from A would amount to £4215 per annum, or 1·88d. per therm sold. Taking the net cost into holder at Works A—viz., 5·19d. per therm (which compares with 5·22d., the average cost for the year 1927 for 46 undertakings in Great Britain, including the London Companies)—this should be corrected to an average repairs works costs of 1·75d. instead of 2·37d., bringing the figure to 4·57d. To this should be added rates, 0·62d., and capital charges on works only, amounting to 1·00d., making a total of 6·19d.

It is obvious that, to produce nearly 50 p.ct. more gas, additions to the works will be necessary. In estimating the amount necessary for the purpose, the figure given by Mr. Alwyne Meade, in "Modern Gas-Works Practice," has been taken as a guide. For a 500-million works, he gives 1¼d. per therm on the annual production for the cost of works only, and in view of the fact that in the present case extensions only are being considered, and that some portions of the plant will be large enough for the increased production, the writer considers 1d. a fair figure. The amount of this will, of course, vary in each individual case, but there can be very few in which the additional gas can be produced without involving capital charges for new manufacturing plant. The total cost, therefore, on the above basis for gas manufactured at A and delivered to the holders at the small works would be 6·19d. + 1·88d. = 8·07d. per therm. Treated as a proposition for the supply of gas in bulk, this does not appear at all attractive. As far as Works A is concerned they would be faced with a large capital expenditure on mains and works; and by selling gas at 8d. per therm at the present time, they would secure interest on the additional outlay and the prospect of making a slight additional profit owing to reductions in the cost of manufacture due to increased output.

On the other hand, the small works are now producing the gas themselves at about this figure, and would not be attracted by such an offer. Further, the concentration of manufacture at A would release further quantities of coke for sale at A, whereas it is to a large extent wanted at the other places, and would have to be railed there at a considerable cost. On the other hand, tar and ammoniacal liquor could be better dealt with at one large works than at several small ones.

Taking another and smaller scheme to supply Works C only from A, and allowing for a 3-in. main 10 miles in length, the cost would be 2·5d. per therm for an annual sale of 68,145 therms.

The general conclusion arrived at from this detailed examination of the problem is that, in the particular case examined, no benefit would be derived from an attempt to concentrate the manufacture in one station, due largely to the fact that the amounts of gas to be transmitted are so small and the cost of mains so high. Our great rivals have the advantage of being able to carry their high-tension cables overhead; and even they are crying out for cheaper methods to enable them to reduce the cost of the transmission lines. There seems to be no general alternative to laying gas mains under a road unless they could be carried by the side of the railways, which the writer believes would be quite feasible.

Doubtless there are many cases in which an investigation of the facts would lead to different conclusions, but the district referred to above is typical of a large part of the country, and one is led to the conclusion that, as a *general* solution of the problem of small works, distribution from central works is not economically feasible.

We may now consider the alternative 2 (*b*).

IMPROVING THE EFFICIENCY OF SMALL WORKS.

It may have been noted that in the foregoing comparison works costs only have been considered. It is not thought possible to effect any saving on distribution costs of the smaller works if they were amalgamated with the larger; and, in fact, it is highly probable that they would be increased.

Under the head of management, centralized control would in some cases effect economies; but these would be, on the whole, so small as not to affect the comparison, and would probably be counterbalanced by increased expenditure under the head of distribution.

There remain the capital charges, which could, in many cases, be reduced with advantage; but any such reduction should be applied wholly to reducing the price of gas, and so strengthening the small works in the fight against competition and assisting in increasing the sales. In this connection it may be pointed out that the first object of the larger company on amalgamation would be a reduction in the selling price, and to achieve this it would be obliged to reduce the capital charges—in other words, to pay less for the small works than the apparent present-day commercial value.

Such a reduction of capital charges can equally well be made

by the small company itself with the same object and with the same result; and the writer considers that any undertaking burdened with capital charges exceeding 3d. per therm sold should take steps to reduce them, and so fit itself to face the future.

What further object would be achieved by the centralized supply of gas? (1) Unvarying quality and purity of the supply. (2) Adequate pressure for present-day requirements. (3) The large towns' standard in the facilities offered for the supply of apparatus and the maintenance of same.

Of these, No. 1 would be satisfied by the supply of gas from a central works; but much can be done to achieve it in small works. No works should be without a recording calorimeter and other necessary instruments; and the writer looks to automatic control of calorific value, by means of which the calorimeter itself will control either the retort house governor or a mixture control so as to maintain a straight line on the chart. The fact that most small works work into and out of the same holder makes it very difficult with hand control to maintain a constant value.

As to Nos. 2 and 3, the bigger undertaking, having command of more capital, would set to work to enlarge mains and services, and to increase the sale of gas by offering every facility for its use, but these things could well be done by the small undertaking, and very frequently are.

This problem of reorganization from within is, however, beset with almost insuperable difficulties. Reasoning from the particular to the general is always a hazardous proceeding; and while there are many small works with reasonable capital charges and affording a good supply of gas, there are doubtless many afflicted with high capital charges, a high price of gas, and an indifferent supply. Any attempt to remedy this locally in a reasonable space of time provides this dilemma: To write down the existing capital in a drastic manner and, at the same time, to invite investors to entrust the company with further capital.

The solution of the problem which the writer favours is that referred to earlier under (2) (*c*) as

THE GROUP SYSTEM.

Amalgamation and joint working, but not with the idea of closing down a large number of the smaller works as manufacturing stations. The writer has in mind the amalgamation of companies in a conveniently administered area—say a county division or a section of the county. Such amalgamations are the feature of commerce in the twentieth century; and the gas industry has not entirely escaped. But how we cling to our isolation!

The benefits to be derived from amalgamation do not rest on the economic feasibility of supply from central stations. The great benefits to be expected would be chiefly financial and technical—financial reconstruction and the fertilizing power of fresh capital for development of sales; purchase in quantities; expert administration; the chemical supervision question solved by a travelling laboratory and expert chemist.

Co-operation is not enough in these strenuous times, though offered in our industry as in perhaps no other. The "walking out" days between the larger works and its small neighbour should end, as all engagements should, in marriage and a complete fusion of interests. Both parties must give up their freedom, and both must learn the other's point of view.

The writer deliberately commenced this paper with a reminder that if "pleasure must be paid for one way or another," so must costly transmission lines for electricity; and, therefore, that there is no reason to fear coming competition. This does not mean, however, that any sort of gas can be sold indefinitely at any sort of price.

The strength of the urban gas undertakings lies in the varied uses of gas. Gas fires are in large towns in almost universal use. What of the small towns selling gas at 1s. 4d. a therm or thereabouts? Have they made a census of their gas fires and the amount of gas consumed in them? And what of those places where the principal sale is still for lighting purposes? Is there a problem of the small works? If so, what are we doing to solve it?

Discussion.

The PRESIDENT (Mr. C. Valon Bennett, of Rochester) said the author desired a good discussion, and he hoped the members would show their appreciation of Mr. Townsend's work by freely expressing their views upon the subject with which he had dealt.

EXAMPLE QUOTED IN THE PAPER.

Mr. W. H. BENNETT (Redhill) said it had been suggested that he should initiate the discussion, because he had been concerned since the war in taking over three adjoining undertakings. None of the schemes in which he had been interested was, however, on all fours with the proposition which Mr. Townsend had put before them. In every case the undertakings were much closer together. He could quite appreciate that there were many instances in which amalgamation would show little benefit to the larger company. The particular case quoted in the paper did not reveal quite the benefits that one would find in most cases of amalgamation; but he would go so far as to say that even in this instance there were benefits which Mr. Townsend had not already brought to their notice. Of course, it was very difficult to judge the merits of the scheme from the figures that were before them. If he himself were going into the question, he would want considerably more information than was contained in the paper. As Mr. Townsend had rightly said, reasoning from the particular to the general was always a hazardous proceeding; and he would not like it to go forward from that meeting that even a case like this did not warrant further investigation. Giving the cost of gas into the holder at Works A as 4·57d. per therm, the author said that to this should be added rates. His (the speaker's) definite opinion was that rates should not be added. They would already have been rated in the towns they were supplying. Again, he suggested that there would be a saving in money, from the fact that Directors' fees would be eliminated in the case of the works taken over; and salaries also would be reduced considerably. If there was complete fusion, and the works were shut-down, no engineer would be required. There would also be other savings. As to the possibility of deriving consumption *en route*, he might be right or wrong in his idea of which places were alluded to in the paper; but he did suggest to Mr. Townsend that, when he had laid his main 22 miles in one direction and 20 miles in the other, the number of consumers would not be those existing at the present time. He would be certain to secure a considerable number of new ones. The capital charges, so far as the main, compressors, and so on, were concerned, would not be increased; but of course there would be the extra cost of pumping. Then having worked out the cost of gas (with which he did not quite agree), Mr. Townsend went on to say he did not think the smaller works would be attracted by such an offer. Of course, if the companies one was proposing to take over were paying dividends, one could not go to the Directors and suggest that, as electrical competition was coming along, they should be taken over on a basis which would show them a less return than they were already getting. In fact, he would go so far as to say that very few Boards would look at a scheme unless they were assured of as good a return as they were then getting—and possibly some increase. Having got as far as this, one had to see whether one could afford to give them the same return on their money and secure some advantage for oneself. He suggested that with the smaller works standing at a higher capital charge than Works A there would be no opposition by the Board of Trade to the charging of a differential price.

THE CASE OF REDHILL.

As a matter of fact, in the case of the Redhill Company there were three differential prices outside the borough. In this way, one could well afford to reduce the prices in the five towns referred to, and still have something left over for oneself. If Colchester happened to be Works A, he did not think Mr. Townsend would be satisfied with a gas sold *per capita* of 12 therms by Works B. Possibly it would not require extensive supervision in that district to raise the sale. It must always be recollected that, under expert management, such as the figures revealed was in operation at Works A, the sales would go up considerably. He did not want to be regarded as maintaining that Redhill was by any means well managed, but he would like to tell them of one incident. They took over a neighbouring Company which was making 12 million c.ft. four years ago, and they were now selling 23 millions—an increase of 98 p.ct. Of course, part of this was due to a reduction in price, although they had a differential there, but it was mainly in consequence of having a man on the spot who was pushing the sale of gas.

EXPERIENCE AT PLYMOUTH.

Mr. P. S. HOYTE (Plymouth) asked whether the author, when he was taking out his calculations for the sizes of his mains, had allowed only for mains adequate for present-day consumption, or whether he had, as everyone should do, provided for mains of sufficient capacity to meet development for (say) 20 or 25 years ahead without re-laying. This was of course a very important point. If the author had allowed for a substantial increase of 100 or 200 p.ct. in calculating the sizes of mains, and consequently the capital charges, it was obvious that when he doubled the sale of gas, his annual costs would be reduced to something like one-half of the 1·88d. per therm sold. They should all of them, if faced with a scheme like this, arrange for mains of sufficient size to meet a substantial increase in consumption. To cite a case within his own knowledge, seven years ago the Plymouth Company took over an outlying works, and closed down the place. They did not even use the gasholders. In the seven years they had actually quadrupled the sales of gas; and they had now a differential of only 6d. per 1000 c.ft. between the selling price in Plymouth and that in the outside district, which was approximately 5 miles away. There should be an amount allowed for compensation for loss of office by Directors and engineers. This was of course a very important item, and must be taken into account. He had recently had occasion to go into the question of further extensions somewhat on the lines of this paper; and with the most liberal allowances for capital charges, he found they could, if these extensions took place, make a very substantial reduction in the selling price of the works he had under consideration, although in the first year, and probably for some few years to come, the scheme would be burdened with pretty heavy capital charges. But these they anticipated would, owing to the lowering of the selling price, the better management, and the freer use of capital, be a constantly decreasing amount, so that they could afford in a few years' time to sell gas at a still lower differential at these works than the one they started with, though even this would be substantially less than the price at which the works were selling gas to-day. This would be a great inducement to the consumers to increase the use of gas. Mr. Townsend towards the end of his paper hit the nail on the head. The real trouble with the small works, and particularly with the very small ones, was lack of capital. He had in mind one undertaking with an enormous percentage of unaccounted-for gas. The expenditure of £3000 or £4000 would pay for itself in a very few years; but the undertaking, although paying dividends, could not possibly raise the necessary capital. As he had said, this was the real difficulty with the small works, which were mostly struggling with an already overburdened capital account. They were not making the sales they should do, because these capital charges had to be met. As the author had

pointed out, the drastic writing-down of capital in a small undertaking did not attract people who had saved their money and wanted to invest it. He presumed that Mr. Townsend, as he was proposing to pump 20 hours a day out of the 24, was going to retain the gas-holders for distribution purposes, and would close-down the remainder of the works.

PORTSMOUTH PROVES AMALGAMATION BENEFICIAL.

Mr. T. CARMICHAEL (Portsmouth) said he thought the majority of engineers, from the point of view of supplying gas at a reasonable price, backed-up by good service (a desirable quality gas at a uniform pressure), regarded it as in the interest of the gas industry as a whole that this question of fusion and amalgamation should be much more to the fore. ["Hear, hear."] Amalgamation did have its advantages, as had been proved in the case of Portsmouth. Some time back his Company took over the Havant undertaking, which was making 33 millions, and in two years they had increased this some 50 p.ct. Another acquisition was Emsworth, 3 or 4 miles farther afield. These works had been making 16 million c.ft., and in twelve months the Portsmouth Company had increased this 18 p.ct. On the dates of transfer they were able to reduce the price of gas. The author concluded his paper by asking: "Is there a problem of the small works?" There was. Distribution from central works, as Mr. Townsend said, was not always economically feasible. This also had been proved in his (the speaker's) area. There was a small undertaking with a make of 8 million c.ft. They were charging 19d. per therm with a very inadequate service, and had 13 p.ct. unaccounted-for gas. Owing to very inflated and exaggerated ideas on the part of one or two of the Directors, the Portsmouth Company were not able to come to terms. He would like to ask Mr. Townsend what were his views on this matter. What were they going to do as an industry? It was not an isolated case; there were many.

A PROTEST ON BEHALF OF THE MANAGERS OF SMALL WORKS.

Mr. W. M. MASON (Manager of the British Commercial Gas Association) said he was desirous not so much of taking part in the discussion as of entering a protest. Going about the country continually, as he did, he had perhaps greater opportunities than most of those present of meeting engineers and managers in all parts. Many of them were managers of small works; and it had been put to him quite often during the last year or two that some of the things which were said about small works were not quite fair. The opinion had been expressed to him that sometimes managers and administrators of large works said things about the inefficiency of small works, which were not borne out by the facts, and that if those folks would study the published statistics they would find that it was not wise to make sweeping statements about inefficiency in small works all over the country. There were many small undertakings efficiently worked and efficiently controlled by very efficient men, who had to do a great deal of work, frequently receiving in return very little thanks. This was a protest which he felt it only right he should enter. Quite obviously Mr. Townsend had made out a strong case for the point of view which he advanced in his paper; but his facts, of course, dealt with a special set of circumstances. Might he (Mr. Mason) suggest that anyone present who was keenly interested in this matter should, along with Mr. Townsend's very valuable paper, also consider such a contribution as that made to a British Commercial Gas Association conference in May of last year by Mr. Frank H. Robinson, of Harrogate, entitled "Linking-Up." In that paper Mr. Robinson gave many facts and figures about linking-up a series of small undertakings around Harrogate. It was on record that this scheme was highly successful, and he knew it had proved so from every point of view—not only from that of Harrogate, but from that of the little places which had been brought in. The big problem was: "Are efficient small works going to consider amalgamation; and if they do not, how are the bigger works going to get hold of the undertakings?" As Mr. Townsend had shown, it would be a fool's bargain to buy plant that could not eventually prove to be a profitable transaction; and, as the author had said, it was obviously a case for every undertaking to be treated on its merits. If it was possible for an undertaking to absorb a smaller works, and it could be shown that the scheme would be profitable, it was wise to go for it. If it was not likely to be profitable, it would not be a wise proceeding.

INEFFICIENTLY MANAGED WORKS A DANGER TO THE INDUSTRY.

Mr. THOMAS GLOVER (Norwich) remarked that he was deeply interested in the subject before the meeting; and he considered that Mr. Townsend had dealt with it very fully and very well. He felt himself in agreement with most of the statements in the paper. For example, he fully endorsed the following: "The great benefits to be expected would be chiefly financial and technical. Financial reconstruction and the fertilizing power of fresh capital for development of sales." This was being proved by those of them who were taking part in this matter of fusion and the working of small concerns independently. Unfortunately it was not possible to connect-up all the little works, which he thought was the right thing wherever practicable. He was sometimes asked by people who saw the activities of his own Company how far it was possible to take gas from one source of supply, and his reply was: "There is no end to it." Really he supposed there was; but he thought that in relays they could quite readily take gas 20, 30, or 40 miles—he meant by making use of the holders in one town, and starting again to supply from that source for the next 10 miles or so. In this way there was practically no end to the distances they would take gas from one central source; but it did not always pay, and it would not pay where one had to buy manufacturing plant and found a big proportion of it obsolete. In these circumstances it often paid to keep a small concern going, and to see that it was worked efficiently. He was in agreement with those who said the really small works were often not managed efficiently. They were not a credit to the gas industry. They were a weakness, because the quality of gas was very uneven, and in some cases it was of an undesirable quality altogether, as regards gravity, inerts, and that sort of thing. A larger concern having an interest in a small one possessed the necessary technical and accountancy staff to give help in every possible way, and re-organization followed, with the result that, under efficient supervision, the quality of the gas was improved; and the commercial side also. There were better methods of dealing with the purchase of coal, better returns in the shape of bye-products, and so forth; and the general result was, as Mr. Carmichael pointed out, that the sales of gas increased very considerably. He (Mr. Glover) had in mind one little concern, the returns in connection with which were showing an increase of 45 p.ct. This was due to the refreshing capital which had been brought in, and to better supervision and organization. The British Gas Light Company had taken over the works; and with enterprise in seeking new consumers and seeing that they were properly supplied, the result had been the increase which he had mentioned. The same tale could be told of many other concerns. This sort of thing was going on in various directions, and it was all to the benefit of the gas industry that it should do so. They must find means of carrying out such schemes. Fortunately his own Company occupied a very good position in this respect. It was so constituted that it could invest money in small concerns, and was busy taking over such companies as were offered, and with respect to which it was thought there was commercial advantage to be obtained. Certainly there was advantage to the gas consumers taken over. It was all to the good, and he was glad the subject had been dealt with by Mr. Townsend.

WORKS UNDER SIX MILLIONS A YEAR.

Mr. C. G. GRIMWOOD (Sudbury) said that so far they had been considering principally the small works of (say) about 50 million c.ft. Might he point out that there were some works that were making only 2 and 3 millions per annum? He believed there were something like 300 works up and down the country making under 6 millions a year. Taking the population figures, it seemed a fair deduction that these tiny works were supplying something like 1 million people. When coming in contact with some of these very small works, one was surprised at the amount of appreciation of gas the various villages showed. It had been said that these small works might be closed-down. Only recently, at one place, the lease ran out, and application was made for a supply of electricity. After full consideration, however, of the price quoted for running a cable from the nearest available point, it was realized that if they had electric light they would also have to cook and heat, and eventually the gas-works were put in order, and were now carrying on with a charge of 8s. per 1000 c.ft. The place belonged to the consumers. It was rather a unique case. The people got together and formed a Co-operative Society, and had obtained 5 p.ct., except for the coal strike year, and were very pleased to be able to maintain a supply. In another similar case, the works were threatened with closing-down, and there again the local people put up the money rather than be without their supply of gas. He was in favour of amalgamation, but he quite agreed with Mr. Townsend that there were only some places in connection with which it could be carried out. In some instances the group system would answer the purpose. If only small places who had not a large works near them could arrange to work more on co-operative lines, they would get much better results than now. These small places very often were only supplying 2000 c.ft. per head of the population; and if taken over by a larger town, the consumption would go up to 4000, 5000, or perhaps 6000 c.ft. per head. He had recently had an opportunity of connecting-up a works at a village 4 miles from his own. In that case, he had put down a low-pressure main; and he would have liked to hear more in the paper about low pressure. Running from large works to smaller works, one would pass a certain number of houses; and it would be more economical to be able to connect those houses without the necessity of putting in governors.

OVERHEAD TRANSMISSION LINES.

He had been interested in Mr. Townsend's reference to electricity. Quite recently he had found himself talking to a farmer friend, who complained bitterly about poles being put across his fields for the supply of current from a central station to an outlying district. He said the people were paying very little for the privilege of having the poles; and the poles were extremely inconvenient to him in working the land. But he thought he would have one great advantage in that, though he was five miles from a town, he would secure a cheap supply of electricity. They quoted him 1s. 6d. per unit, although he had the poles on his farm, within a few yards of his house. The reason they gave for this price was that a transformer would be needed. His farmer friend, however, said he was going to do without the supply.

WORKS UNABLE TO MEET ELECTRICAL COMPETITION ARE A DANGER.

Mr. JAMES TAYLOR (Weston-super-Mare) said he would like to emphasize one point—the great danger to the industry of small works which were unable to meet electrical competition. Within his own knowledge, three small works had been closed-down during the last few years—works making from 3 million to 4 million c.ft. per annum. Undoubtedly they were utterly unable to face the competition of electricity. It must always be borne in mind that it was a considerable disadvantage to the gas industry that such undertakings should go under. His own Company took over a small works six or seven years ago, and as the result of the better resources that a large Company were able to command, and the more efficient methods of obtaining new business, the consumption of gas in that area was now about 400 p.ct. greater than it was at the time of acquisiton. He thought this would be the general experience where undertakings of (say) under 10 millions were taken over.

MAINS AND ROAD-WIDENING PLANS.

Mr. FRANK LIVESEY (Maidstone) stated that, as the result of his experience, before extending along a thoroughfare to any villages, he would in future want to know exactly what were the plans for road-widening. It had been his lot to have mains extending a distance of 9 miles for supplying villages, which had had to be taken up and

relaid at large expense. A road-widening scheme did not provide at present for such a thing as this; and though his Company had been successful in recovering a small proportion of the cost, they had themselves had to bear the greater part. He had had experience of supplying villages from small mains 4 in. and 3 in. in diameter; but he would never dream of doing it again. The point had been raised about picking-up consumption *en route*; and his view was that it was far better to work at an intermediate pressure.

HARD LOT OF THE SMALL MANAGER.

He was interested in a number of small works, and Mr. Mason's remarks had appealed to him. In his (Mr. Livesey's) opinion, the working manager of a small concern—say, about 12 million c.ft. per annum—had to be an "Admirable Crichton" to perform adequately all the tasks that fell to his lot. ["Hear, hear."]; and it was too much to expect of any man that he should undertake canvassing, and things of that kind, in addition. When they said that a larger company would give better service, they were not criticizing the manager of the small works, who had so often a task which it was beyond anyone's power to perform. Recently he had had occasion to turn-down several opportunities because of the road widening difficulty.

"VESTED INTERESTS" AN OBSTACLE.

Mr. J. H. CORNISH (Bridgwater) thought a great difficulty in the matter of amalgamations such as they had been discussing was the "vested interests" built up around these small concerns. He had in mind an undertaking with an output of 8 million c.ft., which had nine Directors, one of whom was 90 years of age. With regard to the advisability of laying high-pressure or low-pressure mains, he was of opinion that there were very great advantages in putting down low-pressure ones. He had gone out 4 miles to a new area and had laid a 6-in. low-pressure main; but he was able to boost if he wanted to. It was an entirely new district; but though they had been there only six or nine months, he could already see 4 million c.ft. consumption. If one could get an idea of the limits of practicability—the size of works which it was worth while taking over, and the maximum distance from the central works—something in the way of formulæ, from the experience of others who had done a lot of work—Mr. Sumner, for instance—this would get over a great difficulty. He himself had been unable to solve it.

WHAT ABOUT THE CONSUMER?

Mr. W. HAWKYARD (Tottenham) remarked that they had heard a lot about the standpoint of the gas undertaking, but what about that of the consumer? This aspect was brought forcibly to their minds by Mr. Townsend's reference to the straight line on the chart. If they gave the consumer a straight line on the chart, they gave him satisfaction; but the author pointed out in his paper that in the case of a small concern working into and out of the same holder, and having horizontal retorts, it was very difficult with hand control to maintain a constant value. This was certainly one point in favour of amalgamation. When Mr. Townsend talked of the calorimeter controlling the retort house governor, he thought he was "hitching his wagon to a star." He did not imagine anyone present would contend that the recording calorimeter had yet "cut its wisdom teeth." Finally, what did the author mean by mixture control on a small works possessing only one holder?

Mr. A. E. SAVILLE (Farnham) inquired of Mr. Townsend what he intended to imply by the term "a small works."

QUESTIONS ANSWERED.

Mr. TOWNSEND, on rising to reply, remarked that, as he had expected would be the case, the discussion had proved far more valuable than the paper; and he was very pleased that so many members had thus shown interest in what he had had to say. As often happened, too, on these occasions, various critics had answered each other; and he was afraid a good many had not quite grasped what he had had in mind in preparing the paper. There was a good deal of loose talk going on about the possibility of a gas grid throughout the country. This was of course a much bigger thing than supplying a few villages from the nearest large works. It meant transmitting gas over very considerable distances. He had taken the case of an area very similar to the Southern District, and had worked out what would be the cost of connecting small towns a distance of 20 miles away in several directions; and if this could not be done economically, it followed that they could not, unless they could get a wonderfully cheap source of gas from somewhere or other, go in economically for a gas grid all over the country. He had never said that one could not supply various small works with advantage from a bigger works near at hand. There were many instances to the contrary. But this did not meet the difficulty; something very much more was wanted. He was glad to have had support from Mr. Glover, whose Company were doing the kind of thing that was needed. Several of those who had joined in the discussion had spoken as if amalgamation and supply from one works were the same thing; but it did not follow at all. The mere fact that the works were all associated in one company and under one management led in itself to economy; and this was the shortest and best way in which that could be achieved. Obviously when a number of undertakings came under the same control, the smaller works, even if they were retained as distinct units, would have the advantage of the greater experience of the bigger company, of the additional capital powers, and of the skilled men which the large undertaking could afford to employ.

DIFFICULTIES OF THE MANAGER OF THE SMALL WORKS.

This was all without saying anything to the detriment of those who under great difficulties were now carrying on in their own way entirely alone ["Hear, hear"], more than likely with a Board of Directors aged 90 or over, who did not in the least understand the problems to be solved. Mr. Bennett's remarks had been most interesting, and he congratulated him heartily upon the success that had attended his efforts in carrying gas to outlying places. These places were, however, closer together than in the scheme discussed in the paper; and this made a lot of difference. Mr. Bennett had queried the inclusion of rates in the Works A costs; and he (Mr. Townsend) was a little doubtful about it himself. It seemed to him to be a debatable point. With regard to the saving under management, this depended upon circumstances, and upon how many vested interests there were; but there must be someone in charge of these works, and the manager would probably be retained. They might save a little on a clerk or two; but as against this they would need more fitters, &c. As to the matter of picking-up new consumers on the way, he had tried not to complicate the paper on the calculation side by including farmhouses and small villages *en route* from which gas consumption might be anticipated. It was true that there might be some little consumption to be obtained in this way, and that this would favourably affect the figures. Reference had been made to the unwillingness to sell of some small companies who were earning fair dividends; but on the other side they had the testimony of Mr. Taylor that recently two or three of the little concerns had closed down. Some people did not seem to realize that the moment the consumers could obtain a reasonably priced supply of light and heat from another source, there would be an end of their dividends on gas at 7s. or 8s. per 1000 c.ft. If only the small undertakings realized this, they would be a little more inclined to negotiate.

THE FINANCIAL ASPECT.

After all, the bigger concerns, if they had to put down mains and spend money, could not afford to pay £1500 per million for works such as they would be likely to acquire. It was a case of mutual agreement; and it ought to be possible for them to get together. The point about differential prices was one to be borne in mind. Very often with a comparatively small extension they could with a differential rate of 6d. obtain sufficient revenue to meet the cost of laying the mains. The difficulty came in when they had to go a really long distance. Then the capital cost was so high that no differential price would be of any use, unless it brought the price up again to what it was in the days of the small company. The great thing, as several speakers had said, was that the larger company reduced the price of gas, and the consumption was sometimes doubled and even quadrupled. Mr. Hoyte had asked what was the basis on which he calculated the cost of the mains. There again he went to the best authority he could find, Mr. Stephen Lacey, and took the most economical size of main to supply a certain quantity of gas a certain distance. That was, in this case, 3 in. and 4 in., involving a high pressure of 33 lbs. or 34 lbs. Other speakers had said they liked larger mains; but in that case the cost, instead of being 1·88d. per therm, might easily be 3d. or 4d. per therm for distribution, and this would put the scheme entirely out of court for anything like 20 miles run. As to allowing for future growth, if he had put in mains twice as big as necessary now, it would have increased the initial cost and made the comparison hardly fair. There was a margin for increase, because 33 lbs. pressure was not by any means high; and they could no doubt get 100 p.ct. increase simply by further raising the pressure. He had allowed 20 hours' pumping for the maximum day, so there was not much time to spare then; but in the summer it would be less than half that. He was pleased to hear Mr. Hoyte's remarks about the success with which he had extended gas to various small places in the neighbourhood of Plymouth; and this experience had been borne out by several other speakers. He had not included in his figures any allowance for compensation or for capital charges in connection with taking over the other works, because that again would have made the comparison worse than it was. He had taken, as he thought, the best possible case, using steel mains, high pressure, and laying the mains, not under the road, but in the verge. If they had to put them under the road, the costs would be enormously increased. Mr. Carmichael had spoken about increased sales and very remarkable results following upon reductions in price. Of course, his was one of the cases, and Mr. Hoyte's was another, in which it was obvious that it would be to the advantage of the district for the big town to go as far afield as possible.

THE ONLY HOPE FOR THE TINY WORKS.

Mr. Townsend went on to say that he had noted Mr. Mason's remarks with sympathy; and he hoped nothing in the paper reflected upon the management of the small works. He had tried to guard against that; and he agreed that there were many small works which were admirably conducted. But there were tremendous difficulties in the way; and anything like co-operation and group working would vastly improve matters for them. Mr. Grimwood had, he thought, in his particular case, done quite the right thing in using low pressure for an extension of 3 or 4 miles. There were obvious advantages in so doing. He did not see any hope of the very tiny works surviving in future unless they were under the management and control of larger companies. Mr. Taylor had emphasized this point, and had shown that it was a matter which ought to be considered, not only from the point of view of individual undertakings, but from that of the industry as a whole. It was not for the good of the industry that one small works here and there should drop out of the race, through lack of capital and lack of help; and they ought as far as they could to assist each other. Mr. Livesey had mentioned being forced to take up mains and re-lay them in connection with road widening. This was a most dreadful case of injustice. The matter had been brought to the notice of those responsible; and he hoped that the gas industry would press for justice to be given in that, and in many other matters. Regarding automatic control, members would find this matter was fully dealt with at the meeting last month of the Eastern Counties Gas Managers' Association. What he had in mind in regard to mixture control was that one or two small works he knew mixed producer gas with coal gas to bring down the quality to about 500 B.Th.U.; and at such works automatic control of the calorific value, by increasing or reducing the percentage of producer gas, did have the effect of giving a fairly straight line on the chart. It had actually been done.

NOTES ON NEW BOOKS.

COAL CLEANING.*

Cleaning of coal at the pit-head is a subject the importance of which is daily becoming more appreciated, not only by the user, but also by the producer. Only the other week we had a further instance of a large gas undertaking contracting for its coal supplies on a maximum ash basis; the colliery concerned having installed a dry cleaning plant. Time after time attention has been directed to the appalling cost of transporting, handling, and treating useless material; and the situation has become far more serious owing to the development of low-temperature carbonization and to the greater care which gas undertakings generally are exercising to ensure that their consumers shall be supplied with a coke eminently suitable for domestic purposes. With regard to low-temperature carbonization, little progress will be made if the smokless fuel placed upon the market is made from a high-ash coal.

Considering the importance of the question of coal cleaning, the literature is certainly meagre; and for this reason we heartily welcome the appearance of a comprehensive treatise, "The Cleaning of Coal," by Chapman and Mott. This, however, is not the only reason; we welcome it also because the authors are so eminently fitted for this work. Both can speak authoritatively, for both have had long, intimate contact—theoretically and practically—with the subject.

In a preface to the volume, Prof. R. V. Wheeler mentions that cleaning processes have been adopted far more widely on the Continent than has been the case in this country. The reason for this lies in the quality of British coal—at any rate, its quality in the past. And with her natural resources Great Britain has, in the past, been able to succeed in competition with foreign producers, who, to gain an advantage, have been compelled to resort to mechanical cleaning. Some of the seams, however, on which the reputation of British coals has been built are no longer available in sufficient quantity to meet an extensive demand. "The time thus seems ripe," says Prof. Wheeler, "for British coal producers to take a leaf from the book of their foreign competitors, to adopt extensively the mechanical cleaning of coal which has enabled those foreign competitors to discount the inherent excellence of British coals."

"The Cleaning of Coal" is a lengthy work of nearly seven hundred pages, and it is not our intention to explain to our readers, step by step, what it contains. Briefly, the thirty-three chapters may be divided into six sections—an introduction to the subject, including the theory of coal washing; the historical development and present position of coal cleaning; wet cleaning processes; dry cleaning processes; miscellaneous considerations, such as screening, pan ash separation, washery control, &c.; and the economics of coal cleaning.

Of course, no cleaning equipment will remove the inherent ash in coal. On this matter the authors observe that it seems likely that the inherent ash may often be less than 1 p.ct., and is seldom greater than 2 p.ct. Speaking of the disadvantages of dirty coal to the carbonizing industries, the authors emphasize the harmful effect of chlorides on refractories, production of breeze, clinker troubles in producers and water-gas plants, and reduced thermal yield of gas per ton of coal carbonized. Gas undertakings at present, they remark, recommend their coke for its smokeless qualities. They would probably attract more customers if they were to recommend it for its ashless qualities. High-ash coke irritates the consumer not only on account of the quantity of fine ash it leaves on burning, but because it proves recalcitrant in the open firegrate.

Naturally, a good deal of consideration is given to the relative merits of wet cleaning and dry cleaning. One of the commonest arguments in favour of cleaning coal is that part of the cost of handling and transporting dirty coal is a direct loss to the consumer, because the mineral matter has no value. The water remaining in coal after washing is equally valueless, and all the cost of handling and transporting the water in wet coal is also a direct loss to the consumer. On this score, indeed, there is no advantage in reducing the ash content of a coal by cleaning it, and simultaneously increasing its moisture content by an equivalent amount. Assuming the same efficiency of refuse removal, at the same cost, dry cleaning holds a considerable advantage over wet washing on the grounds of the cost of delivery to the consumer. Unfortunately, on the smaller sizes of coal, dry cleaning processes are not so efficient as wet processes. Apart from transport considerations, however, the greatest advantage of dry cleaning is likely to accrue to the carbonizing industries. For example, a washed slack charged into a coke oven normally contains at least 10 p.ct. of water. This increases the coking time, reduces the amount of surplus gas available, introduces additional sources of expense, and adversely affects ammonia recovery. The disadvantages of using wet coal in coke ovens are still more pronounced in the manufacture of coal gas. It must in fairness be mentioned, however, that with dry coal there is greater formation of retort carbon, and fine dry coal tends to be carried up the ascension pipes.

The authors sum up the situation in the following terms: "It is difficult to place a monetary value on the advantage of dry cleaning rather than wet cleaning. With nut coal, from which the water can drain almost completely, there is little, if any, advantage. . . . With small coal, however, there may be, for the majority of purposes, a certain advantage; but in the present state of our knowledge a true comparison of the relative values of wet and dry coals for coke manufacture cannot be given."

Sufficient, we hope, has been said to indicate the value of "The Dry Cleaning of Coal." Having read the volume, we should certainly be loth to part with it from our library. Finally, we congratulate the publishers on the excellence of the print, diagrams and photographs, and general appearance of the book.

* "The Cleaning of Coal," by W. R. Chapman, B.Sc.Tech., M.Sc., Ph.D., A.I.C., and R. A. Mott, M.Sc., F.I.C. Published by Chapman & Hall, price £2 2s. net.

COAL GETTING.*

The problem of coal cleaning is also discussed in another book which has just been published. Written by Prof. R. W. Dron, and bearing the title "The Economics of Coal Mining," this volume is one of the most fascinating we have read on the subject; and we heartily recommend it to all our readers. The problems confronting the coal industry at the present day—and no thinking man can afford to be ignorant of these problems—are treated by the author in a clear, penetrating, unbiased way; and we are of opinion that many of those who study "The Economics of Coal Mining" will gain a new vision concerning the coal industry's difficulties. On the question of coal cleaning, the author indicates when it does, and when it does not, pay a colliery to market cleaned coal, and explains by a series of graphs how it happens that it is more profitable for one consumer to purchase the purest coal available, and for another consumer to buy coal at a lower price with a considerable percentage of ash. With regard to the prosperity of the coal industry in relation to its exports, however, Prof. Dron maintains that it is no idle statement that the salvation of the British export trade may lie in the cleaning of coal.

Many of the popular, but mistaken, notions regarding the finance and profits of colliery undertakings are shattered in the author's introduction to his book. He points out that, whereas in 1882 the output per person employed in the industry was 325 tons per annum, the corresponding figures for 1914 and 1927 were 230 and 252 tons per annum respectively. True, collieries in many instances have worked out their best seams, but coincident with this transition there has been the increasing use of electricity for haulage, conveying, cutting, and lighting; and during the same period many deep pits have been sunk, involving large capital outlay, but opening-up good thick seams which could be worked with the minimum of labour. The author's observation is that these two factors—the use of electricity and the sinking of new pits—have been almost sufficient to counteract the disadvantage suffered by the transition from thicker to thinner seams.

Capital considerations which apply to industry generally are definitely inapplicable to the coal industry; and the author states that a remuneration of 9 p.ct. would be insufficient inducement to attract capital to undertake the risks associated with the opening-up of a new coalfield. All mining ventures have a very strong element of risk attached to them, and it has to be remembered that there is absence of remuneration during the development period. Under modern conditions many years must elapse between the time when the first bore is put down to prove a coalfield and the time when the colliery is producing a profit.

Later on in his book—in a chapter dealing with the valuation of a going colliery—Prof. Dron mentions that some colliery companies have enjoyed a prosperous history by taking risks with funds which should be allocated to capital redemption. Instead of investing these funds in standard securities, they have invested them in additional mining ventures where the risk rate of return is applicable. Such a procedure, though often successful, can hardly be described as sound finance, because the risks are being increased beyond the original intention of the investor. Sometimes it turns out disastrously. At certain recent inquiries, there was a good deal of loose talk about the undue prosperity of the colliery companies—a prosperity which was largely due to the system of extending risks. No note was taken of the concerns which had come to disaster by the same system.

Discussing organization, the author calls attention to one of the generalizations contained in the Report of the Royal Commission on the Mining Industry (1925)—viz., that the size of the undertakings usual in the coal industry in Great Britain is not economically the best. Mining engineers generally will not agree that this is in accordance with their own practical

* "The Economics of Coal Mining," by Robert W. Dron, M.A., M.Inst.C.E., Vice-President of the Institution of Mining Engineers, Professor of Mining in the University of Glasgow. Published by Edward Arnold & Co., price 10s. 6d. net.

experience, states Prof. Dron. Comparatively small units under the direct control and management of the owners have in the past produced remarkably good results—results which are not likely to be improved by their absorption into larger undertakings. "One has a suspicion that many of the undertakings showing a loss of from 1s. to 7s. per ton (as exemplified in the Commission's Report) are either at the developing stage, when the whole of the oncost charges are being borne by a small output, or are in the process of exhaustion with a declining output. On the other hand, the undertakings with an output ranging from 1 million tons per annum and upwards must include most of the modern collieries where the development work has been completed and where full advantage is being obtained from the best seams adjacent to the winding shafts."

Particularly interesting is the author's observation that the tendency of the future appears to be towards enhanced values for the low-grade fuels by the extension of their use as pulverized fuel or by the increasing adoption of various forms of low-temperature carbonizing plants. This statement is made in the chapter on power production, in which the author refers to a paper read by the late Mr. W. C. Mountain before the Bradford Engineering Society last year. In the course of his paper, Mr. Mountain pointed out that there is a very large field for independent power plants. Many people fail to realize the difference between the cost of generating electricity in the power station and the cost of this current distributed over long distances. He was of opinion that the super power station is not at all likely to be of any value to the consumer from the viewpoint of reliability of its supply. The general public have very little idea of the stoppages of supply which do occur in conection with the large power stations in this country.

We could write a great deal in praise of this book, for every chapter bristles with interest. However, we will refrain, and conclude by stating that the expenditure of 10s. 6d. for the volume is a sound investment.

MIDLAND JUNIOR GAS ASSOCIATION.

A Meeting of the Midland Junior Gas Association was held at the Council House, Birmingham, on Thursday, Nov. 15—Mr. F. CAUDWELL (Shrewsbury) presiding.

SOME ASPECTS OF THE WORKING OF INTERNAL PRODUCERS, WITH SUGGESTIONS FOR IMPROVED EFFICIENCY.

By FRANK COURTNEY SYLVESTER, of West Bromwich.

[Extract from a Thesis which gained for the Author the Diploma of the Institution of Gas Engineers.]

The section of the installation which is the main source of heat admission to the retorts has been treated as a relatively unimportant matter; but it has been shown that, if all the available heat of the fuel admitted to the producer could usefully be employed only 8·6 p.ct. of the weight of coke made would be required for carbonization, as against the more usual 22 p.ct. (allowing 13 lbs. per 100 lbs. of coal carbonized and a recovery of 60 p.ct. of coke). It is therefore suggested that one of the most likely means of effecting a reduction in the amount of heat lost is the introduction of better designed step-grate producers with intelligent control to secure a regular supply of good producer gas and the avoidance of solid fuel losses.

An ideal producer gas has a high CO content; is of constant quality and pressure, to maintain constant pressure in the flues; and is free from dust.

The points which need careful consideration, and are most likely to bring about the above ideal conditions, are:

(*a*) The exposure of as large a fuel area as possible.
(*b*) The time contact of fuel and air to be as long as possible.
(*c*) Maintenance of the highest temperature possible in the producer consistent with the ash of the fuel being discharged as dust and not as clinker.

With a fuel bed temperature of over 1000° C., less than 1 p.ct. of CO_2 is formed. Further, at low temperatures, a larger time contact is necessary for the attainment of equilibrium. Thus, with a shallow fuel bed and an excess of oxygen, there is no time for the reduction of CO_2 to CO.

With a deep fuel bed the temperature of the fuel will vary throughout; the gases finally passing through the coolest coke. Thus, though there may be ideal conditions in the hottest zones, the percentage of CO_2 in the producer gas will be determined by the time the gases are in contact with the cooler coke. It is for this reason that the gases are withdrawn in many designs below the newly-charged coke.

CARBON MONOXIDE CONTENT OF PRODUCER GAS.

On many works the CO figure does not receive the attention it deserves; but it is most desirable that the gas should be high in CO, owing to its high radiation temperature and high calorific intensity. Carbon monoxide has the highest calorific intensity of any of the gases in producer gas. This figure is useful as a measure of the amount of heat the producer gas can give up to the setting:

$$\text{Fraction of heat given up} = \frac{\text{calorific intensity} - \text{temperature of setting}}{\text{calorific intensity.}}$$

A producer gas having a high calorific intensity will give a higher efficiency than one with a lower intensity. This is important when working modern settings at a high temperature, for the fraction decreases rapidly as the temperature of the setting increases.

Further, a gas with a high CO content is more efficient for heating retorts than is a gas with (say) a high hydrogen content, for, though the gross calorific values of the two gases are almost equal, the net calorific value of CO is appreciably the higher. Also, the heat radiated by the flame of CO is nearly three times that of hydrogen. Hydrogen is an undesirable in producer gas for heating retort settings because of its short flame and the deleterious action of its surface combustion on retort walls.

DESIGN OF PRODUCER.

The producer should be as wide as possible, consistent with constructional requirements—or, in other words, it should approach a square as nearly as may be. Further, narrow producers are uneconomical and hard to operate. A long, narrow producer inevitably has a shallow fire in the back, and has a longer perimeter for a given area. The fuel does not flow evenly, but tends to arch across it, due to the proximity of the side walls; the cooling water is hard to distribute; and the fire clinkers badly.

DRAUGHT CONDITIONS AND WASTE-HEAT RECOVERY.

When working with natural draught, the weight of the primary air to the producer is dependent upon the "pull" of the main chimney, which varies in accordance with the temperature of the waste gases and the atmospheric conditions, thus rendering the admission of primary air far from ideal.

The development of waste-heat recovery is leading to the introduction of induced draught fans, which will give the desired constant draught condition to the producer; and, at the same time, a greater margin of heat is available for recovery when this form of control is employed. The heat required for draught constitutes nearly 40 p.ct. of the heat in the gases leaving the setting.

When utilizing an induced draught fan to create the necessary draught, and a feed water heater, it is possible to reduce the temperature of the waste gases to very little above that of the atmosphere. The efficiency of the fan may be taken as 5 p.ct. The efficiency of natural draught is at its best less than 1 p.ct. Therefore a fan is a much more efficient instrument for producing draught, and in addition it is cheaper in first cost.

THE FUEL BED.

The second problem concerns the fuel bed. This should give as nearly as possible a constant resistance to the passage of the air. The fuel used in gas-works producers usually contains between 13 to 16 p.ct. of ash; and it is the fusion of this inorganic matter to clinker which causes the greatest variation in travel. Clinker troubles are definitely the result of high gasification rates resulting in the temperature of the fuel bed becoming above the fluxing-point of the fusible ash. This tends to retard the flow of gases and reduce the available area of the bed, and acts as a deflector, converting the passage of air into channels. This channelling assists in the formation of more clinker by the intense local heat in the open spaces. The temperature of a producer will increase directly with the amount of fuel gasified in a unit of time. This is dependent upon the air supply; and it is for this reason that a large grate area is recommended to give a long time contact of air and coke, avoiding intense local temperatures and the formation of large masses of clinker.

One type of vertical installation now includes step-grate producers with a grate area of 1·8 sq. ft. per ton of coal carbonized. This appears somewhat high for step grates, as there is a danger of the velocity of the gases through the fuel being insufficient to maintain the temperature necessary for complete reaction. (Tests later show that a grate area of 0·8 sq. ft. per ton of coal carbonized is sufficient for good working with well-designed producers and step grates.)

The method adopted to prevent the formation of clinker in producers is by admitting steam or water to keep the base of the fire comparatively cool. The writer has carried out many experiments to ascertain what advantage can be gained by the various classes of fuel and methods of primary air, steam, and water admission, with special attention to:

(1) The regularity of volume and composition of the gas formed.

(2) The percentage of combustibles, especially carbon monoxide.
(3) Formation of clinker.
(4) Loss of combustible matter in pan ashes.
(5) Dust deposited in flues.

The tests were carried out on an internal producer supplying gas to heat four 5-ton Woodall-Duckham vertical retorts. On this producer, the grate area is equivalent to 0·8 sq. ft. per ton of coal carbonized per day.

TEST No. 1.

Fuel used.—Screened coke from verticals.
Proximate analysis of fuel.—

	P.Ct.
Moisture	0·45
Volatile matter	1·26
True carbon	89·34
Ash	8·95
	100·00

Method of primary air admission.—Doors of producer open, volume regulated by dampers.
Method of cooling plates and front of fire to avoid clinker troubles.—Water only, all plates damp.
Quantity of water passing.—95 lbs. per hour.
Temperature of primary air.—60° C. (taken 6 in. from plates).
Producer fed.—Every 3 hours.
Producer clinkered.—Every 12 hours (half of fire attended every 6 hours).
Producer gas formed.—

Hours After Cleaning.	P.Ct. by Volume.				
	CO_2.	CO.	H_2.	CH_4.	N_2.
1	4·6	25·2	7·7	1·9	60·6
2	4·5	26·1	8·8	1·3	59·3
3	4·5	25·8	7·8	2·1	60·0
4	4·2	26·3	7·2	1·6	60·7
5	4·2	26·0	8·7	1·4	59·7
6	4·9	25·3	8·0	1·8	60·0

Average percentage CO.—25·8.
Average calorific value of gas.—119·4 B.Th.U. net.
Fuel consumption.—13·5 p.ct. of coal carbonized.
Combustible matter in pan ash.—19·8 p.ct. (dry basis).

TEST No. 2.

All conditions same as above, except that fuel was unscreened.
Proximate analysis of fuel.—

	P.Ct.
Moisture	0·14
Volatile matter	1·32
True carbon	85·54
Ash	12·73
	100·00

Hours After Cleaning.	P.Ct. by Volume.				
	CO_2.	CO.	H_2.	CH_4.	N_2.
1	6·1	24·9	9·2	1·2	58·6
2	6·2	24·5	8·9	1·2	59·2
3	5·8	25·2	7·5	1·8	60·9
4	6·0	24·0	7·3	1·8	60·9
5	6·2	24·1	8·4	1·0	60·3
6	6·5	23·8	10·2	0·8	62·3

Average CO . . . . . 24·4 p.ct.
,, calorific value of gas . 113·8 B.Th.U. net.
Fuel used.—14·6 p.ct. of coal carbonized.
Combustible matter in pan ash.—25·3 p.ct. (dry basis).

TEST No. 3.

Fuel used as in Test 1, screened coke from verticals.
Method of primary air admission.—By steam injectors through tubes in communication with the underneath of the grate.
Method of cooling plates and front of fire.—The steam from injectors only; no water.
Quantity of steam used.—34·37 lbs. per hour (20 lbs. per sq. in., $\frac{1}{4}$-in. nipple).

lbs. per hour = 51·4 P × A
where P = Absolute pressure
A = area of nipple.

Temperature of primary air.—240° C. (taken 6 in. from bars).
Producer fed.—Every 3 hours.
Producer clinkered.—As above, every 12 hours (half every 6 hours).

Hours After Cleaning.	P.Ct. by Volume.				
	CO_2.	CO.	H_2.	CH_4.	N_2.
1	4·0	29·0	7·0	1·8	58·2
2	3·1	30·4	7·0	2·4	57·1
3	2·8	31·2	9·4	2·3	54·3
4	3·0	30·0	10·0	1·8	50·2
5	3·5	29·2	8·3	2·8	56·2
6	4·0	28·5	9·2	1·7	56·6

Average CO . . . . . 29·7 p.ct.
,, calorific value. . . . 136·8 B.Th.U. net
Fuel used.—13·7 p.ct. of coal carbonized.
Combustible matter in pan ash.—17·0 p.ct. (dry basis).

TEST No. 4.

Conditions as in Test No. 3, except that fuel was unscreened, as in Test No. 2.

Hours After Cleaning.	P.Ct. by Volume.				
	CO_2.	CO.	H_2.	CH_4.	N_2.
1	5·7	25·0	8·9	2·2	58·2
2	4·3	27·3	7·5	2·0	58·9
3	4·6	26·2	6·2	1·8	61·2
4	4·2	25·8	9·0	1·5	59·5
5	5·7	24·6	9·2	2·0	58·5
6	6·0	24·7	8·4	1·2	60·1

Average CO . . . . . 25·6 p.ct.
,, calorific value . . . . 123·7 B.Th.U. net
Fuel used.—14·0 p.ct. of coal carbonized.
Combustible matter in pan ash.—16·3 p.ct. (dry basis).

TEST No. 5.

Fuel used.—Screened coke from verticals.
Method of primary air admission.—By steam injectors as in Test No. 3.
Method of cooling plates and front of fire.—By steam from injectors; also some water sufficient to keep moist half the plates of the grate, the lower half being dry, and cooled by steam only.

Quantity of water passing	35 lbs. per hour
Quantity of steam passing	8·6 ,, ,, ,,
Quantity of steam and water	43·6 ,, ,, ,,

Temperature of primary air.—130° C. (6 in. from bars).

Hours After Cleaning.	P.Ct. by Volume.				
	CO_2.	CO.	H_2.	CH_4.	N_2.
1	4·4	28·0	11·7	1·9	54·0
2	4·0	28·3	9·3	2·2	56·2
3	4·2	27·8	8·0	2·3	57·7
4	4·2	28·2	10·7	1·7	55·2
5	4·6	26·8	9·7	1·6	57·3
6	4·4	27·0	10·3	1·8	56·5

Average CO . . . . . 27·35 p.ct.
,, calorific value. . . . 131·5 B.Th.U. net
Combustible matter in pan ash.—18·05 p.ct. (dry basis).

TEST No. 6.

All conditions as in Test No. 5 with the exception that water was increased to the quantity of Tests Nos. 1 and 2—*i.e.*, all plates kept moist.

Hours After Cleaning.	P.Ct. by Volume.				
	CO_2.	CO.	H_2.	CH_4.	N_2.
1	7·5	22·1	11·3	1·1	58·0
2	7·1	22·3	9·9	0·8	59·9
3	8·4	21·8	10·9	1·1	57·8
4	8·2	21·9	11·8	1·2	56·9
5	9·3	19·2	12·1	1·3	58·1
6	9·2	19·5	11·6	0·7	59·0

Average CO . . . . . 20·2 p.ct.
,, calorific value. . . . 106 B.Th.U. net
Combustible in pan ashes.—24·6 p.ct. (dry basis).

It will be observed that in Tests Nos. 2 and 4, working with unscreened fuel, the quality of producer gas formed deteriorated about the fourth hour after clinkering. Also the pressure in the flues had been reduced to less than atmospheric—*i.e.*, "pull"—showing that the quantity of gas formed had been reduced. Attempts were made to record this varying pressure in the flues and combustion chambers, but sufficiently delicate instruments, such as a smoke gauge, were not at the writer's disposal. It is, however, recognized that combustion chambers should be worked under pressure; and the above reduction of volume shows the necessity of some automatic arrangement of admitting extra primary air should excessive clinker form at short notice. If this is not done, the secondary air, which is usually constant, will be in excess during this time, resulting in reduced bottom heats with vertical retorts.

The writer strongly advocates screened fuel for producers, and believes that the fine material should be screened out and used in apparatus or plant specially designed for this low-grade fuel—such as boilers working with forced draught and fitted with special grates. With screened fuel the periods between clinkering can be extended. This is desirable in that less pan ash is removed. Also, the losses during the process of clinkering—such as the removal of combustible matter from the fire, the lowering of temperature due to the opening of the doors, and the heat taken from the producer in the pan ash and clinker—are reduced.

In Test No. 3, according to the analyses of gas formed, the producer was apparently working under ideal conditions. This is probably due to the increased temperature of the primary air, which, being saturated with water vapour from the steam, is a powerful absorber of radiant heat.

Though the front of the fire was much hotter, and conditions

for cleaning were not so comfortable for the men, no trouble was experienced with overheating of the plates.

The higher temperature of the fuel bed is also shown by the increased methane content up to 2·8 p.ct., which is the result of direct union of the carbon and hydrogen at high temperature.

It will also be noticed in Tests Nos. 1 and 2 that the loss of the fuel in ashes is much lower when working with the front of the fire dry. When water only is used, the fuel near the bars is incompletely combusted, and the temperature comparatively low; therefore a larger time contact of air and coke is necessary. This suggests that the grate area of 0·8 sq. ft. per ton of coal carbonized in this producer was insufficient for this method of primary air admission.

Test No. 6 shows the importance of carefully avoiding excess water; under these conditions the following reaction was undoubtedly taking place:

$$C + 2H_2O = CO_2 + 2H_2 - 2850 \text{ B.Th.U. per lb. of carbon.}$$

The CO_2 content increased rapidly with a high H_2 formation.

Water or steam are no doubt very useful in assisting to keep the clinker in its least harmful condition.

Limit of Steam and Water Admission to Producer.

Tabulating the results of tests, the limit to which the steam and water can usefully be employed for cooling appears to be between 17 p.ct. and 39 p.ct. by weight of the coke used per hour on the producer.

Test No.	Lbs. per Hour.		Total as Steam.	Producer Gas.		P.Ct. Steam by Weight on Coke to Producer—240 Lbs. Coke Consumed per Hour.
	Steam.	Water.		C.V. Net.	P.Ct. CO.	
1 . .	..	95	95	119	25·8	39·6
2 . .	..	95	95	114	24·4	
3 . .	34·37	..	34·37	137	20·7	14·3
4 . .	34·37	..	34·37	124	25·6	
5 . .	8·6	35	43·6	131	27·3	17·4
6 . .	8·6	95	103·6	106	20·2	43·2

To try to establish more accurately what this figure really is, a producer of the same type was worked with screened fuel. Varying quantities of steam and water were admitted for cooling the front of the fire; the increases being made in stages, and further observations taken on the producer gas formed.

Test No.	Lbs. per Hour.		Total Lbs.	Gas Made.				P.Ct. Steam by Weight on Coke to Producer.
	Water.	Steam.		CO_2.	CO.	H_2.	N_2.	
A . .	28·5	26·07	54·57	3·5	28·2	9·2	59·9	23·4
B . .	31·7	26·07	57·77	4·0	27·5	8·6	60·9	24·8
C . .	37·3	24·11	61·41	4·6	26·4	9·6	59·4	26·4
D . .	43·0	24·11	67·11	5·5	24·5	10·8	59·2	28·8
E . .	37·3	34·37	71·67	5·4	25·6	10·0	59·0	30·7
F . .	43·0	34·37	77·37	5·7	24·2	11·2	59·9	33·2

From the above results it would appear that, when working this type of producer with closed doors, the limit to which steam and water may be admitted is approximately 25 p.ct. by weight of the coke consumed on the producer. To some extent this will depend on the water-steam ratio, as shown in Tests D and E, where in E a higher CO content was found in the gas formed, though the total percentage of steam and water was higher than in Test D, in which case the water gave way to steam.

This shows that the reaction of the H_2O in the producer depends on the form to which it is admitted to the front of the fire—whether as water vapour, wet steam, or superheated steam.

In Test No. 3 it will be remembered that ideal conditions were prevailing with CO content up to 31·2 p.ct. During this time the steam was undoubtedly entering the fuel bed in the superheated condition, as the temperature of the zone immediately in front of the fire was well above boiling-point (actually 240° C.). As the degree of saturation by water of the primary air increases with increase in temperature, a fall in temperature of the zone in front of the bars will, apart from wastage of steam and lowering of the gas quality, result in condensation of water which enters the ash pit.

As mentioned by the writer in a paper before the Midland Junior Gas Association in 1924 (see "JOURNAL," Vol. 165, p. 565), this may lead to trouble in vertical retorts by the water percolating the base of the ash pan and disintegrating brickwork in the vicinity. The ash pan should on this account be kept dry.

Dust Carried Forward from Producer into Flues.

The ash from flue dust carried forward by the producer gas into the combustion chambers is very variable in composition, but generally has a high iron content, and at high temperatures exhibits a great affinity for refractory material containing more than a small percentage of alumina. Rapid slagging of exposed surfaces frequently takes place unless some form of protection is provided. The more porous the material, the greater the danger of slagging by molten ash.

When working the producer with unscreened coke on the previous tests, the quantity of dust carried forward into the CO pockets on this type of plant was found to be 41 lbs. 12 oz. per month, which with screened fuel was reduced to 30 lbs.—the pressure conditions in the flues being approximately equal in both cases. The above weights occupy volumes in the flues to the extent of 1·2 and 0·86 c.ft. respectively. This shows the necessity of designing the flues to avoid sudden contraction in area. Sudden contraction causes friction to the gases, which would throw down the dust and cause blockage and reduced flue area. In this respect the vertical combustion flue system of heating possibly has an advantage over the horizontal combustion flue type, in that any dust carried forward does not settle in the hottest zone where it is likely to flux, but falls down the flues where the temperature is lower and the possibility of fluxing reduced. For accurate gas analysis of producer gas, the flues should not contain large quantities of combustible matter.

In conclusion, the following points are demonstrated:

(1) The proportion of carbon monoxide in a producer gas for heating retorts is of greater importance than the total calorific value of the gas, owing to the high calorific intensity of carbon monoxide.

(2) The use of screened fuel on producers is justified from the points of:
- (*a*) Higher carbon monoxide content in gas formed.
- (*b*) Longer periods possible between attention to fire.
- (*c*) Less solid fuel losses in pan ashes.
- (*d*) Less dust carried forward into flues.
- (*e*) Volume of gases formed more constant.

(3) The limit to the employment of steam for cooling the base of the producer is approximately 25 p.ct. by weight of the coke used in the producer. Above this figure excessive endothermic reaction takes place, with a reduction in the carbon monoxide content of the gas formed.

(4) Air saturated with water vapour is a powerful absorber of radiant heat. Thus the use of primary air saturated with steam presents advantages over the employment of primary air with the bars cooled by water only.

(5) The solid fuel loss in pan ash is reduced by working with the front of the producer dry; and it should be possible to work the producer so that the combustible matter in the pan ash does not exceed 20 p.ct. by weight.

Discussion.

The CHAIRMAN, in opening the discussion, made some interesting observations on the historical aspect of producers. The original producer, he said, was designed in 1839 by Bischof, who used it for metallurgical purposes. A considerable amount of experimental work was done on the Continent before it was introduced into this country. In 1877, a Committee was appointed by the German Association of Gas and Water Engineers to experiment upon generator furnaces; and they published a report. The first furnace applied to retorts on a regenerative principle was installed by the Chartered Company, which now was the Gas Light and Coke Company, at Goswell Road, in 1862. In 1881, Mr. George E. Stevenson, of Peterborough, published records of work done there with this type of furnace; and it was evident that the pioneers in this country had to overcome many difficulties. A considerable amount of work was done by Mr. Valon in 1882. In 1886 there was an extended controversy between Mr. Paterson, of Cheltenham, and Mr. Valon; the former having then in use the Klönne furnace. In 1888, progress seemed to be made; and Mr. Charles Carpenter (now Dr. Carpenter) published the results of his experiences. Discussing the paper, the Chairman drew attention to the fact that the author stated that gases were withdrawn in many designs below the newly charged coke, in order that these gases might be kept away from the cooler coke at the top. A development of this point seemed to have occurred previous to 1903, but in that year a patent was taken out by Mr. Herring, of Edinburgh.

Mr. MCNAUGHTON (Wolverhampton) moved a vote of thanks to Mr. Sylvester for his paper.

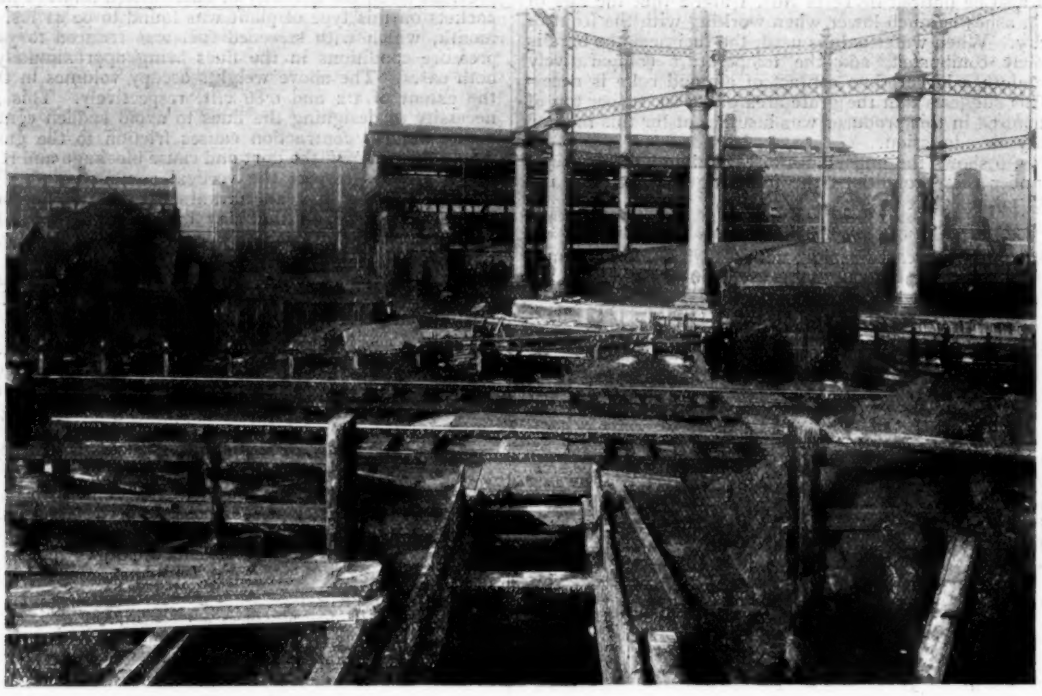
Mr. W. J. PICKERING (Coal Test Works, Birmingham Gas Department), in seconding the resolution, spoke of the working of the Education Scheme of the Institution of Gas Engineers during the past twelve months. He referred particularly to the work done by the District Education Committees, and the effect this was likely to have on the future of the Scheme. They would remember, he said, that these Committees were set up soon after the special conference in London in March of last year; and they had been at work for more than a year. On both the General Education Committee and the Executive Committee which met monthly in connection with the administration of the Scheme (and on which Committee he sat as the representative of the Juniors), the highest opinion obtained concerning the functioning of the District Committees. They had carried through a tremendous amount of work, one of the most important aspects of which was that it had resulted in a fuller realization of the various difficulties associated with the running of the Scheme. For example, difficulties which applied to the isolated student had exercised their minds constantly. The Education Committee were determined that these difficulties should be overcome; and the work of the District Committees would greatly assist in formulating the necessary steps in that direction.

Mr. J. H. GEE, Mr. H. R. HEMS, and others joined in congratulations to Mr. Sylvester on his contribution.

NOTES ON THE LAYING OF A 36-IN. MAIN.

By J. A. GOULD.

[From the November Issue of the "Co-Partnership Journal" of the South Metropolitan Gas Company.]



THE END OF THE MAIN FROM EAST GREENWICH TO THE LOWER SYDENHAM GAS-WORKS.

In July last the work of laying five and a half miles of 36-in. main from Greenwich to Bromley Road, and three-quarters of a mile of 24-in. main from Bromley Road to the Bell Green Works of the South Suburban Gas Company at Lower Sydenham, was brought to a close when the air in these mains was expelled and the pipes charged with gas.

The 36-in. main to Bromley Road consists mostly of pipes having joints of the full turned and bored type. Such large pipes of this kind had never before been used by the Company, and are, no doubt, the only ones laid in London.

The main commences at a connection with the 48-in. main near the Royal Naval College, Greenwich, and runs over Blackheath and through Lee and Catford to a governor house at the Bromley Road end of Bellingham Road. This main is arranged to feed four 24-in. pressure-loading governors, of which two are at present fixed. One of these controls the pressure of the gas supplied to the South Suburban Works, and the other the supply to a 24-in. district main in the Bromley Road. The last-mentioned governor will be used for augmenting, or backing up, the district pressure to the L.C.C. Downham Estate.

The 24-in. main to the Bell Green Works crosses the Bromley Road, and, after traversing the L.C.C. Bellingham Estate, passes beneath the Mid Kent line of the Southern Railway at Bell Green, and enters a meter house just inside the gas-works.

The route followed by these mains presented many obstacles, and a considerable amount of investigation and survey was necessary before the line could be decided. Apart from the obvious engineering difficulties—such as the crossing of railways and streams and main traffic routes, all of which needed special preparations and drawings—the avoidance of sewers and drains, and the pipes and cable ducts and lines of other public bodies, with the minimum amount of excavation and expense, and with due regard for the straightness and gradient of our own mains, demanded constant foresight and attention. Again, the maintenance of traffic services along and across the roads affected by our operations necessitated the provision of bridges and special lighting and other arrangements.

At important crossings, such as railway bridges, tramway routes, &c., where the pipes would be subjected to severe vibration or be difficult of access, special riveted steel tubes were employed; four being used on the 36-in. main, and three on the 24-in. In all cases the headings in which the tubes were laid were filled with concrete which surrounded the tubes.

The first operation to be performed in connection with the laying of the 36-in. main was the insertion of a branch in the 48-in. main connecting East Greenwich and Old Kent Road Works. The 48-in. being an extremely important main, it was necessary that the work should be executed with the minimum delay; and, after careful preparations, necessitating the closest co-operation between district and works, the main was cut out and the branch inserted in July, 1927.

A valve was provided on the outlet of the branch, to stop the flow of gas when the bags were withdrawn. From this valve a short length of main was laid across Romney Road into Park Row, and then capped.

The 36-in. main was laid in three sections, which proceeded simultaneously. No. 1 commenced close to the capped end just mentioned, and continued over Blackheath towards Lewisham; No. 2 at Lee High Road, which proceeded towards Catford; and No. 3 started at Bromley Road by the governor house and worked towards Lee to meet No. 2. Each had its difficulties; but the Greenwich and Blackheath section proceeded most rapidly on account of the nature of the soil in which the trench was excavated, this being gravel and sand, whereas the trenches of the other sections were dug in clay.

As the work continued throughout the winter of 1927-28, some of the work was executed in indifferent weather, the effect of which was to hamper operations in the clayey soil. During the winter months water had constantly to be pumped from these trenches; and for this purpose petrol-driven pumps were employed to augment the ordinary manual pumps. In the very cold period just preceding last Christmas, the excavated clay froze so hard that it was impossible to handle it.

All sections of the main were laid "dead" and tested with air under a pressure of 5 lbs. per sq. in. It was usual to apply a test after 20 to 30 pipes had been laid—depending upon circumstances. A special testing blank flange and clip, which bolted to the socket of the last pipe laid, and was made gas-tight by means of a rubber joint, was used for the purpose. While under the air test, the joints were treated with soap solution to detect leakage, and pressure readings were taken over a period by means of a mercurial barometer.

It may be interesting to describe the chief engineering difficulties encountered in the laying of the 36-in. and 24-in. mains.

36-IN. MAIN.

Crossing of Romney Road by Royal Naval College.

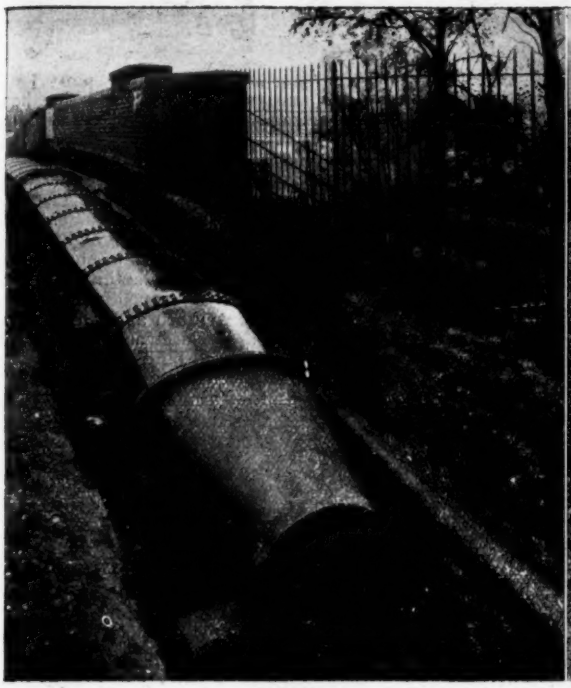
A circular steel tube was laid in a heading driven beneath the tramway track. The heading had to be driven between an 11 ft. 6 in. diameter L.C.C. sewer and the L.C.C. tramway cable duct.

Railway Tunnel in Park Row.

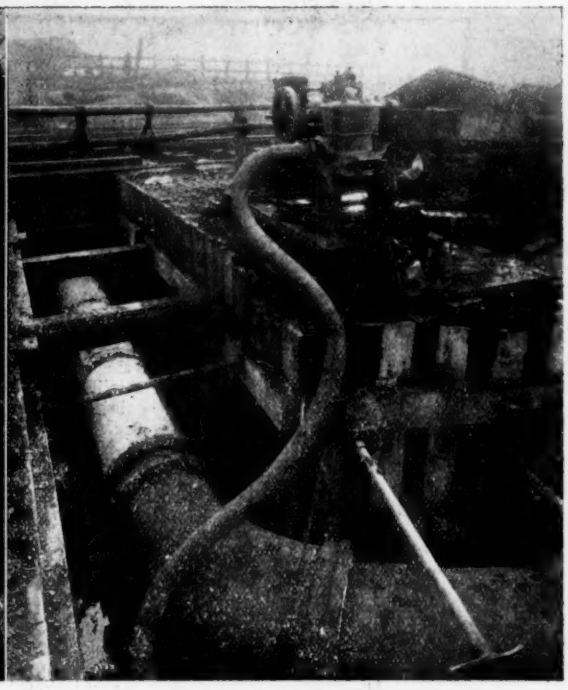
In Park Row, by the Royal Hospital School, a railway tunnel had to be crossed. As the top of the masonry of this was only 2 ft. 9 in. below road level, a special rectangular steel main was used; this being adequately protected against damage from traffic, &c., by means of a steel and concrete covering.

Lee High Road.

A circular steel tube was used to cross beneath the tramway track by Lee Park; and, owing to the congestion of pipes,



Crossing Railway at Bellingham.



Tube under Railway, Bell Green.

cables, &c., in Lee High Road, along which the new main was laid for a length of about 50 yards, it was necessary to place the 36-in. beneath our own existing 12-in. main, and afterwards support the latter and a large water main (by the side of which we had cut the trench) with concrete. As the new main was about 8 ft. deep to the top, the concrete works were extensive, and took a considerable time to execute.

River Quaggy, Manor Lane.

The main was laid beneath this stream, and a tunnel had to be driven beneath the concrete sill connecting the bridge abutments and forming the bed of the river. The floor of the heading was 16 ft. 9 in. below road level, and a steel tube was used for the crossing. It had been anticipated that considerable trouble would be experienced from water percolating through the river gravel; but the heading was actually driven through the underlying clay. Unfortunately, a pebble bed existed just below the floor of the heading, which was conveying a mineral spring. This water, of which 6000 to 10,000 gallons per hour were pumped (two petrol pumps being in action continuously), left a ferruginous deposit on the pumps and along the channel of the road into which it was pumped.

Railway Bridges—Manor Lane and St. Mildred's Road.

The main passed beneath these bridges, but special arrangements had to be made to avoid any possibility of movement of their abutments. In both cases the trenches were heavily timbered to the satisfaction of the railway engineers; concrete stretches being placed in the trench after the pipes were laid. Beneath St. Mildred's Road Bridge the main had to cross the road diagonally, at the same time crossing beneath a sewer. As the abutments of the bridge were only about 4 ft. deep, the greatest care had to be exercised in the work and very massive timbering employed. Added to this, the road is a 'bus route, and heavy bridges had to be constructed to carry the traffic over our trench while the work proceeded. Further, special traffic arrangements had to be made with the highway authorities and police.

24-IN. MAIN.

Bromley Road.

A steel tube was laid beneath the tramway track.

Railway Bridge by Bellingham Station.

The depth available on this bridge was very small, and permission was obtained from the Railway Company for the bridge structure to be slightly altered to permit the main to be laid over it. Space was then available for an elliptical tube, which, when laid, was only just beneath the paving stones. To permit of a possible future lengthening of the bridge, provision had to be made for the tube to be sufficiently long to span two additional railway tracks.

Railway Track at Bell Green.

In crossing beneath this railroad, steel tubes were employed, and laid in an open trench. Before the trench could be cut, the rails had to be specially supported with baulk timbers by the Railway Company, and the live electric rail guarded. Our tubes had again to be sufficiently long to permit of a possible widening of the track.

To protect the steel tubes against damage from stray electrical currents, they were specially insulated with bituminous material and surrounded by concrete, which itself was covered with a similar insulating material. The normal railway traffic continued while our work was proceeding.

GENERAL NOTES AND DATA *re* 36-IN. MAIN.

Statistical.

The average number of men employed on the laying of the main was 251. The number of pipes laid was 2376; 112 bends and 12 syphons being also used. The weight of these castings is about 4800 tons. The average depth of the main was 4 ft. 7 in., and the approximate quantity of soil excavated, measured solid, was 40,700 cub. yards, and weighed about 58,800 tons. The volume capacity of the main is 204,817 c.ft.

Final Air Test of Main.

Air at a pressure of 4¼ lbs. per sq. in. was pumped into the main, and left for a day and a half to cool down. A reading was then taken of the pressure. Twelve hours afterwards another was taken; the loss of air being equivalent to that which would escape from an orifice about $\frac{1}{15}$ in. in diameter under the pressure mentioned.

Charging of Main with Gas.

The air contained in the 36-in. main and the 24-in. main to Lower Sydenham was expelled through an 18-in. vertical pipe about 60 ft. high erected at the South Suburban Gas-Works. The open end of this pipe was provided with a special head containing three layers of wire gauze, to prevent any possibility of an explosive mixture in the main being ignited from an external spark or flame.

The total volume of air in the two mains was over 217,000 c.ft.; and this was expelled by admitting gas under a pressure of 17 in. water into the 36-in. main from the 48-in. main. The 36-in. valve at Greenwich was opened fully about 7.15 a.m. on July 10, and the blowing off was practically completed at 7.55 a.m., but continued until 8.27 a.m. to ensure the completeness of the operation—the change from air to gas being very sudden, as had been anticipated. The air was blown out at the rate of 85 c.ft. per second.

The whole of the work was executed by the Company's regular mains gangs augmented by a large number of odd men. Vast quantities of timber and other stores had to be obtained to enable so large an undertaking to proceed rapidly and efficiently; and it is to the credit of the mains staff, foremen, and men that no hitch occurred in the work even under the most trying weather conditions experienced.

Owing to the nature of the task and the necessity for as little interruption as possible of traffic and other public services, it was inevitable that regular hours could not always be worked, but all demands were met—a striking testimony to the value of co-partnership. Careful drawings were kept of the whole of the main, and the position of every joint recorded, and of other mains exposed in our excavation.

GAS COKE AS FUEL IN HOSPITAL WARDS.

[CONTRIBUTED.]

The beneficial effects of warmth and cheerfulness upon patients has always been fully appreciated by those responsible for the conduct of our hospitals. Nothing contributes more towards the maintenance of an atmosphere of well-being than a bright, smokeless fire in wards and day-rooms.

The disadvantages of open coal fires have long been recognized; and recent experiments with smokeless solid fuels at two London hospitals have led to the introduction of coke fires which not only maintain continuously the desired radiance, but also tend materially towards economy in the cost of fuel. The substitution of coke for coal in the open fireplaces of institution wards has often been attempted, but, in the majority of cases, coke has proved unsatisfactory owing to the unsuitability of the existing grates. If coke is to be adopted as the regular fuel for these buildings, then the ruling authorities will, in all but exceptional cases, have to be prepared for the initial cost of fitting new grates. They will very soon get their money back in the reduction of their fuel bill. They will also have established a permanent improvement in the warmth and cheerfulness of their wards.

Coal is fixed carbon combined with smoke-producing volatile matter; coke is fixed carbon without volatile matter. In the case of both fuels it is from the fixed carbon in combustion that heat is mainly radiated. The volatile matter in the coal assists the combustion of the carbon. Where no volatile matter exists, as in coke, some other medium has to be provided for creating the free and active combustion of the carbon. A first essential for this is to be found in the free admission of air.

In addition to adequate insulation and provision for agitating the fuel, the "Metro" grate provides for this free admission of air. In consequence, it dispenses with the sole usefulness of the volatile constituent, whose soot-depositing flame is relatively negligible as a radiant in an open grate. A coke fire burning freely forms a mass of smokeless incandescent carbon, together with a good deal of lambent flame, radiating heat to its utmost capacity, because it is not intermixed with easily ignitable but only partially consumable volatile. For this reason the field of radiation into the ward is very greatly increased when coke is substituted for coal, provided always that the coke burns freely, as it does in the "Metro" grate.

A trial of these grates has recently been made in two of the London Hospitals controlled by a public body. In one hospital a coke fire has been burning continuously in a ward since it was lighted up eight weeks ago (at the time of writing); all ash dropping through the specially designed bottom grating. The coke used has been carefully weighed and compared with the coal burnt in the grate of a similar ward. In this other ward, as the coal could not be got to burn continuously, two fires were used alternately for twelve hours at a time. The following figures give the result of a month's test:

Gas coke burnt in 31 consecutive days	.	.	.	16 cwt.
Coal " " 31 " "	.	.	.	19 "

This hospital burns 600 tons of house coal per year, and its equivalent in gas coke according to the above figures would be 505 tons, showing a very substantial saving in the year's fuel bill. The Hospital Managers are considering the adoption of 328 "Metro" grates.

The advantages derived from the substitution of coke for coal are not only financial. Compared with household coal there is increased and continuous warmth imparted to the wards; smoke and chimney sweeping are completely eliminated; and rekindling, with consequent chilling effect, is dispensed with. The relatively high proportion of ash in the coke necessitates the emptying of the ash-tray rather more frequently; but this is a simple process.

Perhaps the greatest advantage of all, however, is in the beneficial influence upon the mind, comfort, and health of the patient of a fire that is always rosy and bright.

CORRESPONDENCE.

[*We are not responsible for opinions expressed by Correspondents.*]

The "Babcock" Low-Temperature Coal Distillation System.

SIR,—Your article in the current issue of the "JOURNAL" is opportune in view of the reviving interest in low-temperature carbonization. At the Dunston Power Station, the position presented avoids any theoretical determination of the resultant values of solid products; the carbonized fuel is used for the generation of steam, and its relative percentage to the initial coal provides the basis for exact computation of price. Thus we have, perhaps, the most favourable economic conditions of the system for examination.

Coke and gas appear as equivalent to 76 p.ct. of the original cost. It is not stated whether this 76 p.ct. represents the thermal value, as deduced from the original coal; and no figures are given which would enable, by subtraction of the thermal values of the liquid products, a check. The credit for motor spirit—viz., 1s. 2d.—may be accepted as a stable condition; that for white spirit may be open to but slight argument, as also that for crude paraffin. But many producers will object to 8½d. per gallon for creosote, taking a long view, and judging from average values extant over a period of years. A decline of 3d. per gallon would have an almost vital effect on the "balance." As 6·88 gallons per ton are produced, a diminution of that surplus from (say) 2s. 11½d. to 1s. 3½d. would be sufficient to offset any advantage claimed for the larger installation. Pitch and cresylic prices are variables largely governed by output.

Using a mean value of 2s. for the surplus gives a margin of £2730 on the fuel consumed—viz., 27,300 tons. One infers from the balance-sheet that no provision is made for depreciation of plant or interest on capital. Hence the cited margin must cover these items. No capital figures are given as to the cost of this plant; but one may assume that the margin referred to would not extend beyond depreciation and reasonable interest, and that, if it be doubled, the resultant surplus forms but a mediocre return, with but slight effect on generating charges, and a complex addition to the power station and the sales department.

Viewing the position from the angle of marketing, in lieu of consuming, the resultant solid product for household or boiler fuel uses, which simultaneously becomes a competitor of coal, and taking into consideration the inevitable increment in the cost of the raw coal in the circumstances, it would appear improbable that any process could offer sufficient inducement to warrant a large outlay whether it produces 20 or 25 gallons of liquid products per ton. Operating and maintenance charges and the capital cost per unit of throughput are the features to be regarded and contrasted with high-temperature systems, and the intrinsic value of gaseous in lieu of liquid products. Liquid will shortly face the increasing competition of pulverized fuels, and prices will most certainly converge. Moreover, the present immobility of gaseous fuels—excepting via distribution mains—does not represent the final phase.

D. BAGLEY.

Bagley, Mills, & Co., Ltd.,
124, Victoria Street, S.W. 1,
Nov. 17, 1928.

"Coalite."

SIR,—I have read with interest the leading article in your issue for Nov. 14 with regard to the contract for "Coalite" plant that has been entered into between the South Metropolitan Gas Company and my Company.

There is only one point I should like to raise, and that is in regard to your statement that the burning of "Coalite" is dependent upon, or in some way associated with, the construction of a special grate, in order that it may burn cheerfully.

It may not have been your intention, but the reading of this paragraph may lead many people to believe that "Coalite" is not suitable for the ordinary grate, whereas the whole of our sales and the reputation of the fuel has been established upon its use in standard grates throughout the country. Like every fuel, it naturally shows to best advantage in a scientifically designed grate; but for all practical purposes it may be taken as an axiom that, wherever coal can be burnt, "Coalite" can be used with as good, or better, results, and no special appliances or grates are required.

I thank you for the great interest that you have shown in the announcement, and your encouraging remarks thereon.

W. A. BRISTOW,
Managing Director.

Low-Temperature Carbonisation, Ltd.,
Coalite House,
28, Grosvenor Place, S.W. 1,
Nov. 16, 1928.

[In the article to which Col. W. A. Bristow refers (*ante* p. 453), it was certainly not our intention to suggest that the cheerful burning of "Coalite" is dependent on, or in any way associated with, the construction of a special grate. Here are our actual words: "With regard to the solid product—'Coalite'—there is no question that it is both efficient and popular. In the ordinary firegrate it is easily ignited, burns evenly, and gives a radiant efficiency far in excess of that given by raw coal." At the same time we called attention to the "Metro" grate, designed by the South Metropolitan Gas Company, as being an appliance which "not only encourages the least amount of coke (or 'Coalite') to give of its best in regard to radiant efficiency, but which is so constructed that the householder may enjoy the flame flickers so dear to his heart." In saying this, we were thinking more about ordinary gas-works coke than "Coalite." However, as Col. Bristow observes, better grates mean better results.—ED. "G.J."]

REGISTER OF PATENTS.

Prepayment Meters.—No. 279,107.

HIBBERD, C. E., and ROBERTSON, T., both care of Alder & Mackay, of Wellington, N.Z.

No. 27,340; Oct. 14, 1927. Convention date, Oct. 15, 1926.

This invention consists in gas or like measuring-out mechanism available for use with coins of different denominations in accordance with which when coins of one denomination are employed, the consumption of gas feeds back the measuring-out screw by means of one pair of gears, and when the meter is to be used for coins of a different denomination, one of these gear elements is removed from the axis or spindle on which it has been mounted, and is mounted on a different axis or spindle—for example, on an axis parallel to the first. This arrangement is such as to enable, by the provision for instance of an intermediate shaft on which the same removable gear element may be mounted, the setting of the meter for coins of any of three denominations, whether in fact the third intermediate shaft with corresponding gear train be employed or not.

Gas Purification.—No. 280,165.

KOPPERS COMPANY, of Pittsburgh (Assignees of D. L. Jacobson and H. A. Gollmar).

No. 18,724; July 14, 1927. Convention date, Nov. 5, 1926.

This invention relates to the purification of gas.

The invention consists in employing as wash liquid in the gas washing and actification cycle a solution of a compound of a metal of the tin group of qualitative analysis (viz., arsenic, antimony, and tin), or of metals whereof the sulphide is soluble in an alkali sulphide solution. Various soluble compounds of these metals may be used, more especially those in which the metal is present in the acid radical—for example, sodium arsenite and the like—but the invention is not limited to the use of an arsenite as compared with an arsenate, or to any other valancy state of the metal in combination.

Alkaline solutions containing these materials are capable of absorbing hydrogen sulphide and can be actified by heat, by aeration, or the like, in such manner as to liberate absorbed sulphur in elemental form, and to regenerate the liquid for further use. Accordingly, a solution of this character is circulated through an absorption stage in contact with the impurity-laden gas and through an actification or regeneration stage in the usual manner, preferably removing the sulphur liberated in the actification stage before returning the solution to the absorption stage. It is preferred to accomplish the actification of the fouled solution by aerating it with finely comminuted air, whereby a flotation of the sulphur may be effected.

No. 286,633.

KOPPERS COMPANY, of Pittsburgh (Assignees of H. A. Gollmar).

No. 18,934; July 16, 1927. Convention date, March 7, 1927.

In operating such a process as that described in specification No. 280,165—especially in its initial stages—it is highly desirable to have alkali and arsenic present in a definite proportion. On this account, it is undesirable to rely upon those unskilled in the art to make the necessary additions to the system; and this is particularly true when no chemical control is provided. Mistakes in the preparation and maintenance of the gas purification solution cause many operating difficulties, and may prove costly before proper adjustments can be made. It has been found highly advantageous to mix the necessary ingredients for an alkaline arsenic gas purification process under trained supervision and chemical control, and to supply gas purification material prepared in this manner to the plants where it may be used for the preparation and maintenance of the gas purification solution. It has also been found that a mixture of alkali and arsenic compound is relatively easily soluble, and that its use not only prevents improper proportion of ingredients in the solution, but also facilitates the preparation and maintenance of said solution.

Wet Meters.—No. 298,512.

ALDER & MACKAY, LTD., and ANDERSON, J., both of Edinburgh.

No. 9824; April 9, 1927.

This invention relates to wet gas meters and more particularly to the measuring drums thereof; the patentees pointing out that many forms of such drums have been proposed, and large numbers of tests have been made, with a view to fulfilling the requirements of the existing Acts relating to the sale of gas, obtaining a drum in which the power loss due to its necessary rotation in the water of the meter is low, and providing at the same time a drum of large measuring capacity for comparatively small bulk.

The object of the present invention is to provide an improved or modified measuring drum; and it has been found that this object is attained by employing curved surfaces instead of straight surfaces as far as possible for joining the ends of the vanes of the measuring drum, which form practically the front and back faces of the drum, and making these curves appear concave when looking towards the front and back faces.

Broadly, the invention consists in a drum for wet gas meters, particularly a four-part single type drum, in which the ends of the vanes are joined by curved parts which appear concave when looking in a direction towards them and towards the adjacent face of the drum, so that the gas first passes over a surface convex towards it and then a surface concave towards it, each vane being preferably formed as a single piece of metal.

Cooling Coke.—No. 298,658.

ILLINGWORTH CARBONIZATION COMPANY, LTD., of Manchester, and ILLINGWORTH, S. R., of Radyr.

No. 15,995; June 15, 1927 (Patent of Addition to No. 248,078, of Nov. 17, 1924).

This invention relates to improvements in, or modifications of, the invention described in specification No. 248,078, which relates to the cooling of coke, and apparatus therefor, simultaneously with the drying of drained coal by the sensible heat of the coke. The patent of the retorts or beneath the measuring hopper and the discharge were reproduced.

The present invention relates more particularly to the construction of the cooling wagon (as illustrated in figs. 5 to 8 of the former specification), which comprises a cylindrical chamber mounted to rotate on a carriage which can be moved to receive the discharge from any of the retorts or beneath the measuring hopper and the discharge pipe from the cistern.

Great difficulty has been experienced in opening and closing the door or doors of the cooling chamber, owing to the heat given out by the hot coke from the retorts, since it has to be operated by hand; and it is one of the objects of the present invention to overcome this defect. A further object is to provide an improved form of discharge from the cooling chamber, for the steam generated by the admixture of the hot coke with the wet coal.

The invention is fully described with reference to drawings.

Gas Burners for Furnaces.—No. 299,125.

LUCAS, E. E., of Birmingham.

No. 21, 273; Aug. 12, 1927.

According to this invention an atmospheric gas burner consists of a mixing conduit of elbow form having at one end the nozzle and at the other end a co-axial town gas supply conduit equipped with an air regulator; the elbow of the mixing conduit having passed through it a power gas supply conduit, or air blast conduit co-operating with a power gas supply pipe terminating in the limb containing the nozzle. The power gas supply conduit or air blast conduit extends co-axially along said limb so as to discharge directly co-axially into the nozzle substantially at right angles to the direction of discharge of the town gas.

Low-Temperature Retorts.—No. 299,201.

LANDER, C. H., of Old Queen Street, S.W. 1, and SHAW, J. F., of the Fuel Research Station.

No. 30,365; Nov. 11, 1927.

This invention relates to low-temperature carbonization of bituminous coal and the like in metal retorts, and concerns the type of plant developed at the Fuel Research Station and to be tried-out at the Richmond Station of the Gas Light and Coke Company. It was described and illustrated on pp. 163-4 of Vol. 179 of the "JOURNAL."

The object of the present invention is to provide an improved retort of which the horizontal section is in the form of an elongated figure of which the opposite sides are parallel. The retort is of such form that the rate of increase of its depth and optionally also its width, referred to the corresponding dimension or dimensions where its cross section is least, is greater towards the lower or discharge end of the retort than adjacent the upper or feed end.

Retorts in accordance with the invention may be formed from sections which engage with one another in any convenient manner. For instance, they may be flanged or be formed so as to provide a connection of the spigot-and-socket type between adjacent sections. Preferably the lower end of the retort is arranged to rest on, but is not rigidly secured to, the chamber in which the retort is mounted or to the means located in the base of the chamber through which the carbonized material is withdrawn from the retort.

It is convenient to build-up the retorts from **U**-shaped end sections and plates interposed between these sections exposing substantially flat surfaces within the chamber.

No. 299,202.

No. 30,366; Nov. 11, 1927.

This invention is based upon the observation that undesirable stresses are set up when, as in accordance with the present practice, the lower end of the retort is secured rigidly to means through which the carbonized residue is delivered.

According to the present invention the lower end of the retort is connected with the means in question through the intermediary of a joint permitting relative motion; the cross-sectional areas of the parts concerned being such in relation one to the other as to ensure that when under the action of heat the retort expands, the lower end thereof will not be larger in internal cross section than the adjacent portion of the discharge duct.

Conveniently, in accordance with the invention, a joint of this

character is secured by allowing the weight of the retort to be borne by the lower end of the retort resting on the top of the outlet duct and providing a skirt or socket portion which overhangs the top of the outlet duct and rests in a trough formed round the duct or in the brickwork of the setting. Alternatively, the skirt or socket portion may, as in a known construction, be omitted; and the retort then rests freely on the top end of the discharge duct.

To facilitate relative motion, the contacting surfaces may be coned or correspondingly formed; while to secure a substantially gas-tight seal, sand or the like may be introduced into the trough or round the joint.

APPLICATIONS FOR PATENTS.

[Extracted from the "Official Journal" for Nov. 14.]

Nos. 32,133—32,968.

BATCHELOR, A. E.—"Treatment of gases for production of light sources for therapeutic purposes." No. 32,247.
FRAASS, W.—"Splitting up coke gas." No. 32,405.
HACKFORD, J. E.—"Carbonization of coal." No. 32,198.
SMITH, E. W.—"Gas-meters." No. 32,830.
SMITH METERS, LTD.—See Smith, E. W. No. 32,830.
TOTZEK, F.—"Coke-ovens." No. 32,691.

PARLIAMENTARY INTELLIGENCE.

Gas Legislation and Unemployment.

It had been intended to raise the question of gas legislation in the course of the debate on the Labour Party's amendment to the Address dealing with unemployment, and several members had expressed their desire to do so. So much time, however, was occupied by lengthy speeches that it was not until after the Division had been taken, and the discussion was drawing to a close, that Mr. Hayday (the Labour Member for West Nottingham) managed to get in a brief reference to the subject. Following an appeal to the Government to facilitate the development of our home industries, as a cure for unemployment, he said:

I refer particularly to the gas industry. That industry is hampered and handicapped by obsolete regulations. I think that the most recent of them dates back to 1871. An undertaking must come to this House for powers to obtain fresh capital, and extend its operations. It is a national industry. It is owned by municipal authorities, as well as by private companies, and they have to operate amid all these restrictions. The Chancellor of the Exchequer the other day said that he hoped by the development of electricity to open out new avenues. I say that here is a national industry which employs at the present time at least 60 p.ct. more than the electrical industry. It is capable of employing more people, and there are many indications of a desire to extend its field. These concerns, if allowed to develop, could supply in bulk fuel at a cheap rate and so help industry in general. If there is a Board of Trade representative here, I ask that he shall see whether it is not possible for something to be done to give that industry a fair chance in common with any other industry, and not handicap it by these old-time regulations, which were good in themselves at the time they were instituted to prevent monopolistic control of the industry, but are now obsolete. The industry ought to have an opportunity, in common with all industries, to develop upon lines which would redound to the benefit of the country by the development of the industry and by employing larger numbers of people.

Amending Gas Legislation.

Several further questions on the need for gas legislation were put to the President of the Board of Trade last week by Colonel England, General Clifton Brown, and Mr. Wardlaw-Milne. In each case, however, the reply given by Mr. Herbert Williams (the Parliamentary Secretary to the Board) was merely a reference to the answer given on Nov. 8, to Lady Astor, the purport of which was that while recognizing the need for legislation the Government saw little prospect of finding time for it this Session. It is understood, however, that a representative deputation from the gas industry is shortly to interview Sir Philip Cunliffe-Lister on the matter. A slightly different question by Major Carver elicited a promise that the Board of Trade would take into consideration the amount of employment which such legislation would give, and the benefit it would be to trade and commerce.

De-Rating and Gas Coal.

Colonel Ashley, the Minister of Transport, replying to a question by Mr. T. Williams, said that the proposed scheme of railway freight rebates would not extend to house or gas coal consumed in this country, but would be concentrated on coal for export and foreign bunkers and for iron and steel works. Collieries producing exclusively house and gas coal for internal consumption would obtain the advantage of the general de-rating proposals embodied in the Local Government Bill.

Coal Carbonization.

Mr. WELLOCK asked the Secretary for Mines if he was in a position to say whether any of the processes of coal carbonization had yet reached the commercial stage; and what was the estimated total quantity of coal at present being carbonized per day in this country and in Germany, respectively.

Commodore KING assumed that the question referred to the so-called low-temperature carbonization of bituminous coal, and not to the gas and coke oven industries, which had been in commercial operation for many years and were carbonizing over 35 million tons of coal per annum in this country. Various types of low-temperature carbonization plants on a commercial scale, with a total capacity of, roughly, 100 tons a day, were now in existence in this country, though they were not all working steadily. Regarding Germany, it was stated at the recent World Power Conference that only one plant for the low-temperature carbonization of bituminous coal was now working in that country. This plant was understood to have a capacity of about 65 tons a day.

LEGAL INTELLIGENCE.

WILSONS & MATHIESONS, LTD., v. MEYNELL & SONS, LTD.

(*Continued from p. 476.*)

When the litigation was continued on Monday, Nov. 12, Sir DUNCAN KERBY asked leave to amend the pleadings in order to plead that the use of the device of a swan upon bathroom and lavatory fittings, including taps not being plaintiff's manufacture, was calculated to deceive and cause confusion, and to lead to goods being passed off.

Mr. Justice TOMLIN assented to this application.

More evidence was then taken, including that of Mr. B. H. Green, Sales Manager of the General Iron Foundry Company, Upper Thames Street, E.C.; and Mr. Mathieson was recalled on the question of the trade marks. He admitted that his firm had used the design of a thistle on baths, but that mark had been withdrawn. He added that he was ready to credit the British Waterworks Association with acting in good faith when they applied for a mark of a swan to denote their goods.

The defence was opened on Tuesday, when Mr. WHITEHEAD, K.C., said that, curiously enough, the mark of the swan and the letters "B.W.A." on taps did not constitute a trade mark; they were used purely as an indication of quality. This case was different from many passing-off actions, as very little advertising had been done. Plaintiff's catalogue, added Counsel, did not emphasize "Swan" goods; and he had in his hand a circular issued by plaintiffs which said nothing about "Swan" goods, but only baths in "Swan" white enamel. He contended that there had been no passing-off, as the swan mark never applied, if at all, to anything but baths.

Col. *J. R. Davidson*, Chief Engineer of the Liverpool Water-Works, and a member of the Standing Committee of the British Waterworks Association, gave evidence. He said the mark of the swan was applied for by the Association in 1920. It included a swan and a lily, though the latter was very indistinguishable. The signs stood for purity and plenty. The swan was always associated with the British Waterworks Association's taps, &c.

In cross-examination witness said the plaintiffs' swan looked more like an ugly duckling. [Laughter.]

Mr. *H. H. Finch*, a Director of Messrs. Groves, Ltd., of Liverpool. sanitary engineers, also gave evidence.

On Wednesday a number of witnesses for the defence said they always thought the swan on plaintiffs' baths referred only to the enamel used. Among the witnesses for the defence were Mr. Herbert West, plumber, of Leeds; Mr. W. Ball, Manager of Messrs. Woodhead & Co., brass founders, of Doncaster; Mr. W. F. B. Oulton, Managing Director of Messrs. Dodd & Oulton, Ltd., brass founders, of Liverpool; Mr. L. H. Keay, Housing Director of the Liverpool Corporation (who said he had given orders for "Swan" taps, and received, in every case, "B.W.A." taps, bearing the mark of a swan); Mr. J. Holt, of Messrs. Holts' Patents, Ltd., Liverpool; and Mr. H. Meynell, Managing Director of the defendant firm.

Mr. *Meynell* said that his firm held a licence from the "B.W.A." to stamp taps with the swan mark. His patent cisterns had since 1912 been described as "Swan" cisterns, and had been advertised extensively as such. In 1912 he registered the device of a swan as a Class 18 trade mark for flushing cisterns.

His LORDSHIP, delivering judgment, said it seemed to him that, in one sense, the issues which had to be decided were, at any rate, of the same kind, both in the action and the application to amend the register. One pleasant aspect of the case was that nobody suggested that anybody had acted otherwise than perfectly honestly. He was satisfied, and found as a fact, that the "Swan" white label was used on the white porcelain enamel baths of the plaintiffs, and had become in the minds of the public as associated either with them, or with the London Scottish Foundry, in connection with baths. He was satisfied, however, and found as a fact, tha the word "swan" was not recognized in the trade as the general house mark of the plaintiffs or of the London Scottish Foundry. He made that observation because the use of the swan had been very limited by the plaintiffs as regards catalogues, &c., and he therefore held that the swan mark was not made out as known and associated with the plaintiffs as a general house mark. He thought plaintiffs' mark was associated with enamel. The applicants, on the motion to rectify the register, had not discharged adequately the onus that rested on them that there would be confusion by reason of two marks being employed side by side in trade. He held that the allegation of passing-off and that the goods were calculated to deceive failed, and therefore the action and motion for rectification of the register also failed, and would be dismissed with costs.

MISCELLANEOUS NEWS.

TUNBRIDGE WELLS GAS COMPANY.

Board of Trade Inquiry.

A Draft Order made under section 10 of the Gas Regulation Act was the subject of an inquiry at the Offices of the Board of Trade, in London, on Friday, Nov. 16, by Mr. J. F. RONCA (Director of Gas Administration). The opposition to it was slight, affecting only matters concerning roads and bridges. The Order, however, is a comprehensive one consisting of 87 clauses and two schedules.

The Order gives powers for the amalgamation of the Crowborough Gas Company with the Tunbridge Wells Gas Company, and provides for the conversion and consolidation of the capital of the Company. The undertaking becomes a sliding-scale one. Compensation is to be paid to the Directors of the Crowborough Company for loss of office, but the present Secretary of the Crowborough Company—Mr. E. M. Baigent—is to be taken into the employ of the amalgamated Company on the same terms and conditions as those now applying to him in the Crowborough Company. The limits of supply of the latter Company will be taken into the area of the Tunbridge Wells Gas Company, and certain additions are made to the existing limits of supply; but the price for gas in the Crowborough limits may exceed the price charged to the consumers in the Tunbridge Wells Gas Company's area by 7d. per therm for one year after the amalgamation, and by 4d. per therm for the following twelve months. Unissued ordinary capital of the Tunbridge Wells Company, amounting to £25,000, and now authorized to be raised as "D" capital, is to be raised, as and when the Company think fit, by the issue of sliding-scale stock and preference stock, or of either; while further powers are given to raise an additional £80,000 in the same manner—this sum to include premiums. The existing "A," "B," and "C" stocks of the Tunbridge Wells Company are to be converted into sliding-scale and maximum-dividend stocks in certain proportions—the sliding-scale stock to be subject to a standard dividend of 4 p.ct., while the maximum dividend capital is 5 p.ct. Total borrowing powers to the extent of £108,975 are provided for in the Order in respect of the existing capital, while there are also powers to borrow on mortgage up to one-half of the paid-up capital at the time of borrowing. Powers are also given to create a special purposes fund, a renewal fund, and a reserve fund; while a profit-sharing scheme is also provided for. The Draft Order also contains a large number of what may be regarded as standard clauses applying to gas undertakings, including making provision for showrooms and houses for the Company's workmen, agreements between the Company and other gas undertakings, the purchase of gas in bulk, &c.

Opposition was originally offered to the Order by the East Sussex County Council and the Kent County Council, but only the latter appeared in active opposition. As regards the East Sussex County Council, it was stated that certain protection which had been given to them by the Crowborough Company's legislation, which went farther than that provided by the general law, had been re-enacted in the form of a special clause in the present Order, and that this had disposed of that part of the oppositon. Similar protection as regards a certain bridge was asked for by the Kent County Council, but this was refused by the promoters on the ground that the East Sussex case was a special one, and that it was not thought fair to deprive that County Council of rights which they already possessed, merely because of the amalgamation of the Crowborough and Tunbridge Wells Companies.

Mr. N. S. PAIN, representing Messrs. Rees & Frere, Parliamentary Agents, on behalf of the Tunbridge Wells Gas Company, explained the general features of the Draft Order, and said that a satisfactory arrangement had also been come to with the Mid-Kent Gas Company as regards adjustment of areas, and also with the Southern Railway Company. The position with regard to the Kent County Council, however, was somewhat different, inasmuch as it was being asked that further protection should be given them as regards a particular bridge than was afforded by the general law. Inasmuch as this matter was discussed at great length in connection with the Northampton Gas Order of 1925, he did not propose to argue it at length, but relied upon the arguments and decisions in that case—when further protection to that granted by the general law was refused—in support of the attitude of the Tunbridge Wells Gas Company in refusing the protection asked for by the Kent County Council.

Mr. *Arthur Valon*, Consulting Engineer to the Tunbridge Wells Gas Company, said the Kent County Council asked to be put in a privileged position; and as adviser to the Tunbridge Wells Gas Company, he saw no reason why that should be done. In all the cases in which additional protection had been granted to road bridge authorities by gas companies, it was by agreement; but his view was that, in the absence of such agreement, road and bridge authorities should not have extra protection unless it was granted to all such authorities by general Act of Parliament. The position with regard to the East Sussex County Council was different, as it merely perpetuated an existing agreement between the East Sussex County Council and the Crowborough Gas Company. If the East Sussex County Council had asked for this extra protection now for the first time, it would have been refused by the Tunbridge Wells Gas Company. Indeed, the same protection which the East Sussex County Council had under the agreement with the Crowborough Gas Company had been refused to them in regard to other parts of the area.

Mr. H. S. BRACKER, representing the Kent County Council, cross-examining Mr. Valon, said that the opposition mainly related to the Ashurst Bridge crossing the River Medway, which at present had a roadway of only 11 ft. in width; the bridge being 11 ft. 6 in. between parapets. The point was that the County Council asked that the Gas Company should pay for the removal and reinstatement of any mains that might be upon that bridge if the latter should, at any future time, be widened.

Mr. *Valon* replied that there are no mains over this bridge at present, and were not likely to be for two years. That would give the County Council plenty of time to widen the bridge if they wished to do so, and the mains could be laid as the County Council desired; but in any case he refused to agree to the condition asked for.

Mr. BRACKER said that such protection had been granted to County Councils in the Cranbrook Electricity Order of 1928 and in the Herne Bay Electricity Order of 1926.

The DIRECTOR remarked that these were Electricity Orders granted by the Ministry of Transport, and not by the Board of Trade. However, he added, he would consider the point, and come to a decision in due course.

BOSTON GAS EXTENSIONS.

Application for Board of Trade Order.

What was described as one of the most important events in the history of the Boston Gas Light and Coke Company took place on Monday, Nov. 5, when the Directors and representative shareholders assembled in the Board Room at the Gas-Works to consider a proposal (which was unanimously approved) to apply to the Board of Trade for an Order empowering the Company to remodel and extend their entire works and plant and re-organize their capital, with a view to meeting the growing demands of the district.

Alderman T. Kitwood, J.P., Chairman of the Company, presided, and was supported by the following Directors: Messrs. J. W. Thorns, J.P., R. G. Shadbolt, J. G. Clark, J.P., Ernest Clark, and S. Marjason. Mr. W. C. Chapman (the Company's Engineer and Manager) was also present.

DIRECTORS' STATEMENT.

To give some idea of the rate of progress and output of the Company, it may be mentioned that whereas in the year 1883 the amount of gas sold was 36½ million c.ft., in 1927 it was nearly 148 millions. The increased sales are due in a great measure to the many and varied uses of gas which have gradually come into existence in respect of power, heating, and cooking, in addition to lighting, and to the effective modern gas burning appliances in use.

It has been evident to the Directors for some time past that, if the present demand is to be effectively met, with every probability of a continued increase in the consumption, additional provision would very shortly have to be made by renewals, improvements, and extensions of the existing works, together with increased storage capacity.

In the early part of this year the Directors instructed their Engineer and Manager to prepare and submit to them a comprehensive report for the remodelling and extension of the entire works and plant, and of the leading trunk mains to supply the growing demand for gas.

The report and plans were duly completed and considered by the Directors. The estimated cost of carrying out the entire work amounts approximately to £40,000, of which about £30,000 would be apportioned to capital and £10,000 to revenue.

The ways and means of meeting this expenditure would be provided by the issue of the £15,000 remaining capital authorized by the Act of 1871, and by the increase of the Company's borrowing powers from one-quarter to one-half of the amount of paid-up share capital.

The amount to be borrowed would be raised either by the issue of debenture stock or by mortgage. Certain lands comprising an area of about three acres belonging to the Company and adjoining the present works would be utilized (when authorized) for the proposed extensions.

It is the intention of the Directors to carry out the proposals contained therein from time to time as occasion requires and as opportunity offers; the details in all cases being subject to review and, if necessary, revision. The Clerks to the Company were accordingly requested to take the necessary steps to promote an application to the Board of Trade for a Special Order under section 10 of the Gas Regulation Act, to authorize the Company to extend the works to their adjoining lands; to increase the Company's powers to borrow money from one-fourth to one-half the amount of their paid-up share capital as indicated; and to arrange for the holding of an extraordinary meeting of the shareholders in due course to approve the application.

GROWTH OF THE COMPANY.

The CHAIRMAN said that the Company had grown from small beginnings to some considerable size, and it must have been obvious to all those who had held shares in the Company for some time past that, in consequence of the great increase in the consumption of their products, they were labouring under difficulties, and that the time had arrived when they must begin to consider the extension of their plant.

The share capital of the Company in 1872 was £35,000, and it remained the same to-day. In so short a period, relatively from the inception of the Company, the revenue account had increased from about £10,000 in 1872 to a revenue capital of £40,000 to-day. In the year 1872, the gas sold was approximately 37 million c.ft., and it was now about 143 million c.ft. Then they had 2000 consumers, and now they had 6300. They used then under 5000 tons of coal,

and they now consumed 12,000 tons. The coal cost in 1872 was under £4000; it was roughly about £16,000 to-day.

Another point of interest to the shareholders was that the capital per million c.ft. sold in 1872 was £943, and to-day it was £245. In 1897, they had 300 cookers installed in the town and neighbourhood, and this year they had nearly 4000. This would be sufficient evidence of the rate at which gas consumption was increasing. This year they had radiators, fires, and wash-coppers in use to the extent of about 17,000. They had increased since 1922 in the direction of the sale of gas by 31 p.ct., and consumers since 1922 by 1135.

£40,000 CAPITAL.

These figures, the Chairman said, would be sufficient indication that the time had now arrived, in the judgment of the Directors, when they must consider ways and means to increase their plant. They would find in the Directors' statement that they were applying for powers to issue the remaining portion of their capital, amounting to £15,000, and that they should have power to raise £25,000. Their capital would then be £40,000. He was not prepared to say how that capital would be raised, or exactly how it would be applied. They had already indicated to the shareholders that they wished to carry out this work and to expend the money as and when they thought it was best needed.

It would be obvious to them that one of the most important things they had to consider was a gasholder. They were constantly renewing their existing mains, and as time went on they would have to take them into those parts of the town where fresh houses were being built. This meant the expenditure of a very considerable amount, which was necessitated by the exigencies of the times. They recognized that the Company supplied an article of public utility, and that though they might not have revenue all at once commensurate with their outlay, yet they recognized that the public had claims upon them, and that they must endeavour to meet these as far as they possibly could.

These were the principal points. This Order was to regularize the lands already in use, and to seek power to extend their operations by putting up new plant on land which was not at present used for gas purposes. The power to create debentures would be conferred upon them. Whether they decided to raise money by mortgage or debentures would have to be considered.

Councillor C. MAWER seconded the resolution, which was carried unanimously.

BRITISH SULPHATE OF AMMONIA FEDERATION, LTD.

EIGHTH ANNUAL REPORT.

The following extracts are from the eighth annual report of the Council and Executive Committee of the Federation for the thirteen months ended June 30, 1928.

The past year was the thirty-first year of propaganda work undertaken successively by the Sulphate of Ammonia Committee, the Association, and the Federation. On Dec. 1, 1926, Nitram Limited became responsible for propaganda.

WORLD'S PRODUCTION AND CONSUMPTION OF FIXED NITROGEN.

During the year under review, there was an increase of 420,000 tons, or about 34 p.ct., in the production of the forms of nitrogen enumerated below; Chile nitrate contributing 190,700 tons, and the other forms 229,000 tons to this total. The total consumption increased by 289,300 tons, or 22 p.ct., following on an increase of 54,000 tons, or 4⅛ p.ct., in the previous season. The following figures are offered as fair estimates of the output of the various forms, but strict accuracy is not claimed for them:

World Production and Consumption of Nitrogen in Metric Tons of Pure Nitrogen, for the Fertilizer Years

—	1924-25.	1925-26.	1926-27.	1927-28.
Production—				
Bye-product sulphate of ammonia	278,300	296,700	303,200	336,300
Synthetic sulphate of ammonia	255,000	289,200	300,000	366,100
	533,300	585,900	603,200	702,400
Cyanamide*	115,000	150,000	180,000	197,000
Nitrate of lime	25,000	30,000	81,000	101,000
Other forms of synthetic nitrogen†	66,100	120,700	133,400	211,400
Other forms of bye-product nitrogen†	47,400	47,700	40,300	55,200
Chilean nitrate of soda	367,500	399,400	199,600	390,300
Total production	1,154,300	1,333,700	1,237,500	1,657,300
Consumption—				
Consumption of manufactured nitrogen	786,800	934,300	1,037,500	1,210,700
Consumption of Chilean nitrate of soda	363,000	324,200	275,200	391,300
Total consumption	1,149,800	1,258,500	1,312,700	1,602,000
Agricultural consumption about	1,020,000	1,117,000	1,200,000	1,450,000

* Excluding cyanamide made in Japan, which is included under synthetic sulphate of ammonia.
† Including ammonia liquor used for industrial purposes.

The increase in production and consumption of nitrogen during the year under review is the largest which has ever taken place in a single year, and is equivalent to the total annual world output of 25 years ago. While the Chilean producers have reason to congratulate themselves on an average increase of 42 p.ct. in the world consumption of their product (made up by 30 p.ct. in Europe and Egypt, 48 p.ct. in the United States, and 44 p.ct. in other countries), Chilean nitrate only contributed about 24 p.ct. of the total output of nitrogen in the world during the year. The larger use of Chilean nitrate has undoubtedly been due mainly to the heavy reduction in price which followed on the institution of "free selling." Prices fell in consuming markets on the Continent from about £12 14s. per ton in the spring of 1927 to about £10 10s. in 1928—a reduction of 17 p.ct. Producers of other forms of nitrogen, chiefly synthetic, have secured an increase of about 16 p.ct. in consumption: and prices for sulphate of ammonia and forms of nitrogen other than Chilean nitrate show a reduction of about 7 p.ct. compared with those for 1926-27. While the total consumption in Germany decreased slightly during the year, chiefly owing to the financial difficulties of farmers, a remarkable expansion in the use of nitrogen has taken place in other European countries, the United States, and the Far East.

The continued popularity of sulphate of ammonia is evinced by a steady increase of about 13 p.ct. in its use. It is still the most widely used of nitrogen fertilizers; and the expansion in the demand for other forms of synthetic nitrogen has been of the order of 22 p.ct. Fertilizers containing nitrogen in more than one form, and fertilizers combining phosphoric acid and potash with nitrogen, have found ready acceptance with farmers all over the world. Our members, Synthetic Ammonia and Nitrates, Ltd., with the help of Nitram Limited, successfully introduced on the market a new form of nitrogen called nitro-chalk—a mixture of ammonium nitrate and calcium carbonate containing nitrogen both in ammonia and nitrate form. Revised estimates for the coming year (1928-29) indicate an increase of 200,000 to 250,000 tons in the output of synthetic nitrogen, and of about 100,000 tons in the form of Chilean nitrate. As stocks of nitrogen at the end of June, 1928, were not unduly heavy, and the outlook for farmers is no worse than a year ago, the chief nitrogen producers in the world have decided to maintain last year's level of price for the coming season.

GEOGRAPHICAL DISTRIBUTION OF NITROGEN CONSUMED.

British and American exports of sulphate of ammonia for the last four calendar years were:

—	Exported from		Total.
	United Kingdom.	United States.	
	Tons.	Tons.	Tons.
1924	263,012	115,047	378,059
1925	248,752	122,498	371,250
1926	150,167	174,159	324,326
1927	251,640	140,679	392,319

Ton = 2240 lbs.

The figures in the following table are to be taken as estimates only:

Consumption in Metric Tons of Pure Nitrogen.

Countries.	Fertilizer Year 1927-28.				
	Ammonium Sulphate Equivalent.	Chilean Sodium Nitrate.	Calcium Cyanamide.	Other Forms of Synthetic Nitrogen.	Total.
Group 1.— Scandinavia, Russia, Baltic States, Germany, United Kingdom, Holland, Belgium, France, Switzerland, Austria, Czechoslovakia, Hungary, Roumania, Jugoslavia, and Bulgaria	346,120	143,890	155,110	228,870	873,990
Group 2.— Spain, Portugal, Azores, Madeira, Italy, and Sicily, Egypt and other Mediterranean countries	67,130	58,650	14,370	15,320	155,470
Group 3.— Indian Empire, Ceylon, Philippines, Straits, Dutch East Indies, Siam, Borneo, Japan, Korea, and China	179,210	13,040	10,550	2,070	204,870
Group 4.— Africa (excluding Egypt) and neighbouring islands	2,550	5,590	..	130	8,270
Group 5.— United States, Canada, Central and South America, West Indian Islands, Cuba, Puerto Rico, and Hawaii	142,590	168,350	16,180	26,620	353,740
Group 6.— Australasia	3,790	1,810	..	100	5,700
Total	741,390	391,330	196,210	273,110	1,602,040

Comparative Figures for Fertilizer Year 1926-27.

Group 1	344,750	94,800	139,600	184,200	763,350
,, 2	59,200	47,500	17,400	9,900	134,000
,, 3	139,000	9,300	7,400	250	155,950
,, 4	2,500	3,900	..	160	6,560
,, 5	106,800	119,000	16,200	7,230	249,230
,, 6	2,900	700	..	10	3,610
Total	655,150	275,200	180,600	201,750	1,312,700

The consumption of "ammophos" is included under calcium cyanamide.

The calcium cyanamide made in Japan is converted into ammonium sulphate, and is included under the latter.

HOME PRODUCTION AND DISTRIBUTION.

The figures for total production are taken from the Alkali Inspector's report, and relate to the calendar year, while the remaining figures relate to the "fertilizer" year commencing July 1 in each year. Hence the quantity stated below as exported for "1927" was exported during the year July, 1927, to June, 1928. The figures represent English tons of sulphate of ammonia.

—	Total Production of Ammonia as Sulphate of Ammonia. (Based on Alkali Report.)	Production of Sulphate/ Ammonia as such.	Exported. (Customs Returns, excluding Channel Islands and I.F.S.)	Used for Home Agricultural Consumption.	Nitrate of Soda Used for Home Agricultural Use.
1924	467,072*	415,000	261,130	153,200	40,000†
1925	442,402*	394,850	223,210	168,650	35,000†
1926	331,348*	322,270	137,320	169,340	33,000†
1927	434,532*	471,230	302,604	167,720	37,000†

* Basis 25 p.ct. ammonia. † Estimated.

(N.B.—The total consumption of Chilean nitrate is estimated at 70,500 tons, as against 51,000 tons for last season. The bulk of the increase appears to have been used for industrial purposes.)

HOME AGRICULTURAL CONSUMPTION.

The table given below indicates that sales of sulphate of ammonia for agricultural use in the home market showed a slight falling-off last season. This was due to the difficult financial position in which many farmers found themselves. The total annual consumption of pure nitrogen in the United Kingdom for all purposes is now about 53,000 tons, of which about 11,000 tons is used in industry.

The detailed figures for sulphate of ammonia are as follows:

Home Consumption in	Scotland.	Ireland.	England, Wales, and Channel Islands.	Total.
1924-25	42,800	22,600	87,800	153,200
1925-26	44,930	26,140	97,580	168,650
1926-27	43,670	28,280	97,390	169,340
1927-28	41,880	26,700	99,140	167,720

EXPORTS.

With the return to more normal conditions of production in the coke oven districts, exports have been resumed on a satisfactory scale. The total quantity exported was 302,604 tons of sulphate of ammonia—an increase of 120 p.ct.

The following figures show the increases in the principal markets:

—	1926-27.	1927-28.
Spain, Portugal, Canaries	50,994	85,050
Java	4,293	29,610
Japan	37,667	100,915
China	24,206	49,800
West Indies and Mauritius	8,917	14,958
India and Ceylon	4,500	11,291
South Africa	353	1,694

The total consumption of sulphate of ammonia in India and Ceylon was about 30,000 tons, and practically the whole of the local production in India was consumed in India and Ceylon.

As a result of successful experimental work, the Sudan has now begun to buy on a commercial scale.

GENERAL AVERAGE PRICES.

The following are the average prices per ton for all deliveries, home and export, free on rails at makers' works, in single bags free:

—	For 20·4 P.Ct. Nitrogen.	For 21·1 P.Ct. Nitrogen.
	£ s. d.	£ s. d.
1924-25	10 18 0	12 5 6
1925-26	9 11 3	10 18 9
1926-27	8 8 7	9 16 1
1927-28	7 14 2	9 1 8

NITRAM LIMITED.

The agreement between the Federation, Imperial Chemical Industries, Ltd., and Nitram Limited was approved by the Executive Committee, and signed during the year.

HOME PRICES.

The following are the prices charged to British farmers per ton delivered to buyer's nearest station, in recent years:

Sulphate of Ammonia.

—	1925-26. Neutral Basis, 21·1 P.Ct. Nitrogen.	1926-27. Neutral 20·6 P.Ct. N. Minimum.	1927-28. Neutral 20·6 P.Ct. N. Minimum.
	£ s. d.	£ s. d.	£ s. d.
July	12 5 0	13 1 0	12 6 0
August	12 5 0	13 1 0	9 18 0
September	12 7 0	11 7 0	10 0 0
October	12 9 0	11 9 0	10 2 0
November	12 11 0	11 16 0	10 5 0
December	12 13 0	11 18 0	10 8 0
January	12 15 0	12 0 0	10 11 0
February	12 18 0	12 3 0	10 13 0
March/May	13 1 0	12 6 0	10 13 0
June	13 1 0	12 6 0	10 13 0

Nitrate of Soda.

15½ P.Ct. Nitrogen.

Spring price about	£ s. d. 14 0 0	£ s. d. 13 10 0	£ s. d. 11 10 0

N.B.—The above prices for nitrate are calculated on the same delivered basis as the sulphate prices; the net price at U.K. ports was about £1 per ton less.

MEMBERSHIP.

The Federation numbered on June 1, 1928, 403 members (a decrease of 3 on 1926-27), whose annual production represents about 91 p.ct. of the total annual output in Great Britain and Ireland on the basis of the production for the calendar year 1927. The decrease is due to alterations in constitution and amalgamations, not to withdrawals. The Federation continues to represent a very large proportion of the output in India and South Africa.

EXPORTS OF SULPHATE OF AMMONIA

From the United Kingdom, in Tons, for the Fertilizer Year ended May 31 in each Year.

Taken from Customs returns. Ton = 2240 lbs.

—	1923-24.	1924-25.	1925-26.	1926-27.	1927-28.
France	18,917	26,943	3,610	..	..
Channel Islands	1,330	964	1,553	1,082	1,106
Spain	50,449	99,558	68,304	36,426	66,289
Portugal	1,771	1,233	2,922	2,244	3,100
Canary Islands	9,722	12,802	14,756	12,324	15,661
Italy and Sicily	5,675	9,018	4,898	2,851	3,982
Egypt	2,460	4,481	3,143	1,455	577
Sudan	..	50	45	70	1,550
Java	35,327	35,660	28,534	4,293	29,610
Japan	84,936	36,141	48,397	37,667	100,915
China	10,827	1,245	8,034	2,738	16,312
Hong Kong	..	6,530	10,420	21,468	33,499
West Indies, British	3,545	3,955	2,682	2,740	4,445
British Guiana	7,214	5,970	5,123	2,183	6,271
Ceylon	1,650	2,754	6,384	3,492	8,833
India	636	509	5,712	1,006	2,458
Mauritius	6,043	5,206	7,358	3,994	4,242
Total, with other countries	259,604	262,095	224,763	138,401	303,702

THE NATIONAL BENZOL COMPANY.

Annual Dinner of Sheffield Division.

Members of the staff of the Sheffield Division of the National Benzol Company, Ltd., gathered at the Grand Hotel, Sheffield, on Friday, Nov. 16, for their fifth annual dinner.

The special guests of the evening were representatives of the coke oven plants and chemical works in the area associated with the Company, among whom were Messrs. G. A. Hebden (South Yorkshire Chemical Works), a Director of the Company; H. H. Berresford (Staveley Coal and Iron Company); R. Ray (Thorncliffe Coal Distillation, and President of the Coke Oven Managers' Association); W. H. Russell (Chairman of the Coke Oven Managers' Association, Midlands Section); P. B. Nicholson (Cortonwood Collieries); and C. P. Finn (Manvers Main Collieries). Messrs. Hebden, Nicholson, and Finn have recently concluded an extensive tour in Canada and the United States, visiting the principal coke ovens and chemical plants in those countries. Other guests included Mr. A. Hittinger, General Manager of the National Benzol Company, and the managers of adjacent divisions.

During the evening a presentation from the staff of the Sheffield Division was made to Mr. R. J. Smith, who is shortly relinquishing the position of Divisional Manager of the Sheffield Division to take up a senior appointment at the Company's Head Office.

It was announced that Mr. C. H. Wagstaff (Chesterfield), the present Assistant Divisional Manager, has been appointed Divisional Manager for the Sheffield Division; Mr. H. Holmes (Leeds), Assistant Divisional Manager; and Mr. H. E. Atkinson, Sales Superintendent.

NEW GAS-WORKS OF THE MANCHESTER CORPORATION.

Progress at Partington.

From an interesting illustrated article in the "Manchester Guardian" of Nov. 8, it appears that the new gas plant of the Manchester Corporation at Partington is rapidly approaching completion.

The new works occupies a large area of flat, marshy land not far from the Ship Canal and from Flixton; and though still clearly incomplete, the existing buildings indicate the large scale upon which it has been designed. A 36-in. steel main, thirteen miles long, joins the plant with the distributing centre in Manchester; and on Nov. 9 this main was filled with gas from the undertakings in the city, and the large gasholder at Partington was also for the first time used for storage. Within the next six weeks the plant already installed will begin to deliver gas into the 5-million holder, and the first section of the new installation will be taking its place with the other works in supplying the city's requirements.

Though it will be some time before the Department feels itself in a position to open the installation officially, it is hoped that one of the units, capable of producing 8 million c.ft. a day, of which there will be five in the completed plant, will be at work earlier. Each of the units, of which a portion of the first has been completed, will consist of an equipment of Glover-West vertical retorts capable of producing 4 million c.ft. per day, and horizontal retorts of equal production made by Messrs. Drakes, Ltd., of Halifax. The verticals will be the first to go into action, and the stokers are already beginning to build up the fires to make the producer gas.

The equipment of the plant is adequate. It generates its own electricity by means of three water-tube boilers, mechanically fed, and capable of evaporating 15,000 lbs. of water an hour. All parts of the plant will be electrically served. The ammonia-recovery system will be capable of extracting 50 tons of sulphate of ammonia a day.

When powers were sought in 1921 for the building of this plant, 5752 million c.ft. of gas were sold; during the year ended March, 1928, the sales amounted to 7073 million c.ft. This is the measure of the expansion which the Partington plant will be called upon to meet; and in so doing it will supersede the Gaythorn Works, which will be used for distribution purposes.

LOW-TEMPERATURE CARBONISATION, LTD.

Success of "Coalite" Smokeless Fuel.

The Eleventh Annual Ordinary General Meeting of Low-Temperature Carbonisation, Ltd., was held on Nov. 19 at Winchester House, Old Broad Street, E.C.—Sir ARTHUR WHEELER, Bt., D.L., J.P. (the Chairman), presiding.

The CHAIRMAN said that the Board decided to treat this first year of operation as part of the development period, as the works were not put into full operation until July, the last month of the accounting year. There had, therefore, been placed on the accounts the burden of the full overhead charges, and also the cost of establishing the considerable goodwill which the Company now enjoyed in the name "Coalite," and for which a very efficient sales organization had been established. In addition, much expense had been incurred in connection with the design and construction of several new works. Three of these had already been contracted for, and others were still in the negotiation stage; but in each case nothing had yet been taken into account in the assets.

IMPROVED FINANCIAL POSITION.

The financial position of the Company had been considerably improved. He wished to make it clear that the process itself was undoubtedly a very profitable one, and a method of dealing with small coal which gave a far better return than any other known system. For example, they could buy to-day washed smalls for 9s. per ton at pit. The cost of labour at the works was under 3s. per ton. The total cost, including labour, upkeep, repairs, maintenance, general charges, administrative wages, insurance, carting, &c., was under 4s. per ton—they might call it 13s. per ton "all in." For the products, "Coalite," coal oil, and motor spirit, there would be received at to-day's prices just about double this figure, and that was without taking credit for anything for the gas. From each ton of coal they produced about 30 therms of gas; and at any plant working the process where the gas could be piped to a gas company, there would be a further profit of 2s. 6d. to 3s. per ton by selling the rich gas at 2d. per therm.

AGREEMENT WITH SOUTH METROPOLITAN GAS COMPANY.

In this connection they would have read with satisfaction the announcement that the Board of Management of the South Metropolitan Gas Company had taken a licence to use their low-temperature carbonization process, and would produce "Coalite" for London from new plant to be erected at their Thames works site at West Greenwich. It needed no words from him to remind them of the commercial and scientific eminence of the Board of Management of this great Company. Their action in making this contract with their Company was regarded in the gas-making and coal industries as being of the utmost significance; and it was bound to have a profound effect upon future development. Arrangements for the erection of the new works were proceeding with the utmost rapidity, and the plant should be in full production in time for next winter's trade. Negotiations were also proceeding in connection with a further works to be erected on the north bank of the Thames; and their Board might be able to make a definite announcement on this point very shortly.

Col. W. A. BRISTOW (the Managing Director) reported that the works were 1000 trucks behind in the delivery of urgent orders. This time next year the position would, he hoped, be different, inasmuch as there would be several works in production instead of only this small works at Barugh.

ROMANCE IN THE GAS INDUSTRY.

How the gas industry, as one of the most effective branches of public utility service, rescues the wonderful products from coal, and thus acts as the necessary link for the dye and artificial silk industries, was demonstrated in an address given by Mr. W. M. Mason, the Manager of the British Commercial Gas Association, to a large and very appreciative meeting of the Birmingham Business Club at the Grand Hotel, Birmingham, on Nov. 13.

Mr. Mason stated that, after over a century of effective service, gas was more strongly and broadly entrenched in the scheme of modern civilization than ever before. Old monopoly methods had been displaced by a new spirit of service to consumers, who now included in one way or another, practically every one within reach of gas supply.

Though gas might not be so much in the public eye, it was being increasingly utilized, not only in the home, but in industry. In Birmingham practically one-third of the output was for trade and industrial use, and many of the 3000 trades in which gas was now an effective working partner were in the Birmingham area.

Mr. Mason paid a tribute to the local Gas Department. The citizens of Birmingham, he said, had good reason to be proud of their gas undertaking, which was one of the most efficient and best organized public departments in the whole gas industry.

A number of representatives from gas undertakings in the Midlands were present by special invitation, and several took part in an excellent discussion which followed.

TEXTILE MACHINERY EXHIBITION.

An Exhibition of Textile Machinery, promoted by the "Textile Recorder," is being held at the City Hall, Deansgate, Manchester, from Nov. 14 to 24; and among the exhibits are a number of gas-using machines and other appliances.

The Selas Gas and Engineering Company, Ltd., are displaying, among other numerous exhibits, various automatic gas and air mixing apparatus, which, though they carry out automatically a scientific operation, are simple in ordinary commercial use. The adoption of the pre-mixed gas and air system enables extensive economy to be obtained in gas consumption; and greatly improved results are secured. The firm claim that their system offers an economy in gas alone ranging from 15 p.ct. to 50 p.ct., according to nature of work. It offers many other advantages, for it considerably enhances the over-all economy of the operation or process. It affords uniform temperature of unfailing regularity, resulting in increased output and improved results. It is safe and reliable, and automatically adjusts itself to all demands under all conditions. Whether applied to direct or indirect heating, it can be set to give any class of flame required—oxidizing, neutral, or reducing—and can be relied upon to maintain any of these conditions with surprising precision.

The firm are also showing a Selas industrial gas lighting plant. Their stand is illuminated by this system, so that those interested are able to judge of the results for themselves. The plant is especially designed for mills, works, factories, warehouses, laundries, and public buildings of all kinds, as well as for exterior illumination.

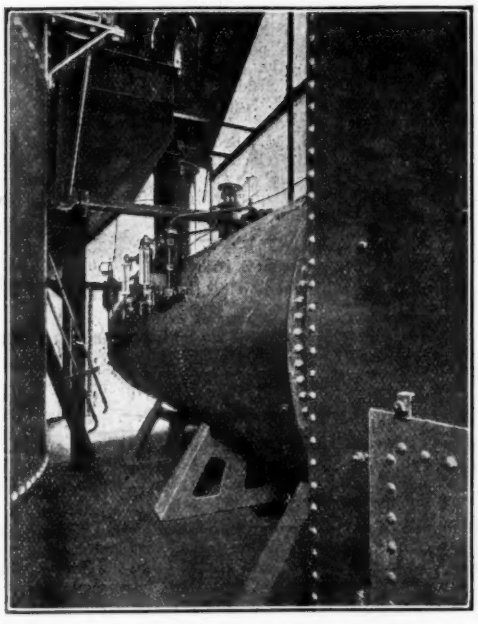
Messrs. Joseph Stubbs, Ltd., Textile Machine Makers and Iron Founders, of Ancoats, are showing a patent quick-traverse cotton gassing frame with ventilating hood, for gassing yarns from single flanged bobbins, spools, cops, &c., all unwound over the top, or from double-flanged bobbins unwound from the side on to paper or wood tubes. Burners for ordinary gas are of the atmospheric type, while for "intensified" gas, or a mixture of gas and air, a specially designed and efficient burner is supplied. There is a patent ventilating arrangement made of strong sheet steel, for carrying away the fumes, &c., from each burner.

Messrs. Stubbs are also showing a vertical burner gassing frame for gassing yarns at high speed from single-flanged bobbins, quick traverse spools, &c., unwound over the top, on to wood or paper tubes. The frame embodies improved burners with two jets designed to ensure the minimum gas consumption with maximum efficiency for high-speed gassing. The yarns are moved in and out of the burners by guides fitted with porcelain ends, which may be quickly taken out when necessary. These porcelain ends are fitted to prevent the wear which occurs with the use of the old-type enamelled wires. The yarns may be passed through the flames once or twice as desired. Pre-mixed gas and air is recommended for this machine.

Messrs. Arundel, Coulthard, & Co., Ltd., of Stockport, are showing a patent vertical burner gassing frame of the downward exhaust type. The machine is of an entirely new design. It is stated that perfect gassing is ensured by the guide for the yarn being part and parcel of the burner itself. The movement for guiding the yarn in and out of the flame is separate from the actual guides. The yarn is always kept in the centre of the flame, and at a certain fixed distance from it. The burner itself consists of a series of holes in a vertical tube; and, owing to its position, it avoids all chance of the holes becoming blocked up by fluff or dirt. So, keeping the mixture of gas and air constant, the holes in the burner always the same size, the yarn always in the centre of the flame, and the flame guarded from any draught of air by special hoods, it can be guaranteed that the gassing of the yarn will always be regular.

Among the exhibits of Messrs. Ernest Turner & Co., of Manchester, is the "Parex" high-speed gas singeing machine, which prepares the cotton whiskers for the singeing process by thoroughly drying them by means of a hot air blast; the air being heated by the products of combustion from each burner. The "Parex" operates with an oxidizing flame. The result is that the whiskers are treated as valuable fuel; and the heat of their combustion is utilized in the singeing process. The products of combustion are drawn from the fume hood, and passed through a copper drying cylinder; and the waste heat is used to dry the cloth prior to its coming in contact with the first hot air blast.

KIRKE
PATENT WASTE HEAT
BOILERS
now working on
WATER GAS
PLANTS



Photograph of a recent installation. The flue on right introduces the waste gases into the Kirke Waste Heat Boiler, and these are discharged at the other end of the boiler.

NOTE THESE POINTS:

COMPLETE COMBUSTION
of the "Blow" Gases.

NO PRIMING
because the boiler is horizontal.

NO LEAKAGE
at inlet tube-plate because scale cannot fall on the inlet tube-plate as in the case of a vertical boiler.

SAVING OF SPACE
because the boiler is elevated.

TUBES CAN BE EASILY CLEANED
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COAL TRADE REPORTS.

From Our Own Correspondents.

NORTH-EAST COAST.

The market on the whole has been satisfactory during the past week, in that export trade for periods ahead has again shown improving prospects. The prompt position remains difficult, as there is still a shortage of shipping, and bad weather on top of this has caused considerable trouble. Collieries which have coal sold have been let down by the non-arrival of boats, and this has adversely affected the prompt market. In other cases there has been congestion and delay owing to the authorities not seeing their way to re-opening loading berths which, in the opinion of shippers, could now be usefully occupied. Such difficulties are very disappointing in face of the distinctly better tone which has been noticeable of late, but trade for next year is still regarded more hopefully, and inquiries are on a satisfactory scale.

Gas coals are little changed, though some of the better makes are well booked for some time. Wear Specials quote 15s. to 15s. 3d. f.o.b., and best qualities 14s. 9d. to 15s. Seconds and others are 13s. to 13s. 6d. Coking coals have been rather better taken, but many brands are weak at 13s., while 13s. 6d. is difficult to get for even the best qualities. Durham unscreened bunker sorts have shown improvement. Best qualities quote 13s. 9d. to 14s. 3d., with seconds at 13s. to 13s. 6d. Northumberland screened steams are well sold, and best qualities ask 14s. to 14s. 3d. Smalls are still a difficulty, and are inclined to accumulate.

Gas coke is quoted at 19s. 6d. f.o.b. for shipment, but holders are discounting the price slightly.

YORKSHIRE AND LANCASHIRE.

Gas coal is in request under existing contracts, and there are indications that next year's figures will be somewhat similar to those now operating.

The demand for industrial coal is rather spasmodic, with washed doubles and singles predominant. Prices vary in accordance with the conditions in each particular consuming area, and recent values are not being quite maintained.

The export market is chiefly concerned in regard to South Yorkshire hards and washed doubles, both qualities being well sold ahead and practically unobtainable for prompt business.

The following are the Humber bunker and export prices (f.o.b. usual shipping ports):

South Yorkshire—Hards, Association, bunkers 19s. 3d. to 19s. 6d., export 16s. to 16s. 6d.; screened gas coal, export 15s. 6d. to 16s. 6d.; washed trebles, export 15s. 6d. to 16s.; washed doubles, bunkers 17s. to 17s. 3d., export 15s. to 15s. 3d.; washed singles, export 13s. 9d. to 14s.; washed smalls, bunkers 13s. 9d., export 10s. 9d. to 11s.; smithy peas, export 16s. 6d. to 17s. 6d. per ton.

West Yorkshire—Hartley's (f.o.b. Goole), bunkers 16s. 3d. to 17s. 3d., export 14s. to 15s.; screened gas coal, 14s. to 15s.; washed trebles, 15s. 6d. to 16s.; washed doubles, 13s. 6d. to 14s.; washed singles, 13s. to 13s. 3d.; washed smalls, bunkers 13s. 3d., export 10s. to 10s. 6d.; unwashed trebles, export 14s. 6d. to 15s.; unwashed doubles, export 12s. to 12s. 6d.; rough slack, export 8s. 9d. to 9s. 3d.; coking smalls, export 8s. 6d. to 9s. 6d. per ton.

Derbyshire and Nottinghamshire—Top hards, bunkers 19s. 3d. to 19s. 6d., export 15s. 6d. to 16s. 6d.; cobbles, export, 15s. 6d. to 16s.; washed trebles, export 15s. 6d. to 16s.; washed doubles, export 13s. 6d. to 14s. 3d.; washed singles, export 13s. to 13s. 6d.; washed smalls, bunkers 13s. 6d. to 13s. 9d., export 10s. 6d.; unwashed doubles, export 11s. 6d. to 12s. 6d.; rough slack, bunkers 12s. 6d. to 13s., export 8s. 6d. to 9s. per ton.

Yorkshire, Derbyshire, and Nottinghamshire—Screened steam coal, bunkers 17s. to 18s., export 13s.; gas coke, export 21s. to 22s. 6d.; furnace coke, export 19s. to 19s. 6d.; washed steam: Goole (West Yorks.), 16s. to 16s. 6d., Hull (West Yorks.) 17s. to 17s. 3d., Hull (South Yorks.) 17s. 3d. and 14s. 6d. to 15s. per ton.

MIDLANDS.

Members of the coal trade are not entirely agreed in their apportionment of responsibility for the continued slackness of demand for household fuel. Mild, open weather has obviously been an important factor; but some students of the position lay more emphasis on the improved carbonization of coal and the increasing recourse of the public to gas and electric heating and cooking. This, they say, has caused a greater displacement than is commonly appreciated in the market for crude fuel.

Some merchants state that the pressure for best grades is still putting some strain on supplies. There is no general tension, however. Taking the Midland coalfields as a whole, there is no difficulty in keeping pace with current requirements in any branch. There are instances in which collieries outside the combine whose contracts have kept them uninterruptedly busy since the early parts of the year are now beginning to feel the relaxed condition of the market.

Many of the colliery sidings are congested. Slacks are offered at prices ranging from 5s. up in order to clear the way for operations as occasion offers. Some pits are not working more than two days a week, however. Those in which anything like full time is worked are very few. One of the strongest features of the market is the demand for Derby hards. Prices generally are unaltered.

CONTRACTS OPEN.

Exhauster.

The Gas Department of the Borough of Newcastle-under-Lyme invite tenders for the supply, delivery, and erection of a steam driven gas exhauster. [See advert. on p. 553.]

Test Holders.

The County Borough of Burnley invite tenders for the supply and erection of two 11 ft. test holders, &c. [See advert. on p. 553.]

GAS REGULATION ACT APPLICATIONS.

SPECIAL ORDERS.

Boston Gas Light and Coke Company.

To authorize the use of scheduled land for gas purposes, to increase the borrowing powers of the Company, &c.

Sandown Gas and Coke Company, Ltd.

To extend the limits of supply of the Company, and to make various financial and other provisions.

DECLARATIONS OF CALORIFIC VALUE.

Harrogate Gas Company (Boroughbridge Limits).—460 B.Th.U. (July 1, 1929.)

SECTION I.

Carmarthen Gas Company.

The maximum price now authorized in respect of the supply of gas by the undertakers is 6s. per 1000 c.ft.; and the price which they have asked the Board of Trade to substitute for this is 1s. 8d. per therm, with an additional maximum charge of 3d. per therm for the hire of any prepayment meter, cooker, and fittings.

GAS REGULATION ACT ORDERS.

SECTION I.

Louth Gas Light Company.

As from the 1st inst., the standard price in respect of gas supplied by the Company shall be 14d. per therm.

Salford Corporation.

As from Nov. 12 the maximum price in respect of gas supplied by the undertakers is 15d. per therm.

TRADE NOTES.

Eighty-Seven Oil-Purifiers.

Among the contracts received by Super-Centrifugal Engineers, Ltd., during the past two or three weeks are included eighty-seven for Sharples British-Made Oil-Purifiers, of which fifty-two were ordered by Messrs. Harland & Wolff, Ltd., of Belfast.

High-Grade Steel Plate.

Messrs. F. Braby & Co., Ltd., Eclipse Works, Glasgow, have just produced a brochure dealing with their high-grade steel plate work. Their manufactures include metal casements, steel flooring and roofing, steel chimneys and hoppers, and all kinds of metal work used in gas plants.

Morris Conveyors.

Messrs. Herbert Morris, Ltd., of Loughborough, have published a most interesting booklet, No. 481, dealing with the many varied types of conveyor apparatus manufactured by them. The firm makes every design of conveyor for every description of work, from coal elevators in gas-works to potato conveyors. Nearly fifty years of experience have enabled Messrs. Herbert Morris to tailor their conveyors to suit the needs of every customer.

Furnace and Oven Insulation.

The subject of insulation of industrial furnaces and ovens is dealt with in Bulletin No. 108L of the Celite Products Corporation. The booklet contains details and illustrations of furnace and flue designs, together with methods of insulation. The Company state that drawings are available showing methods of insulation recommended for practically every type of heating equipment, and the engineers of the Corporation will submit detailed advice on the insulation recommended for any specific insulating problem.

Compressed Air Tools.

Messrs. Holman Bros., Ltd., have recently published a brochure dealing with their various products in connection with compressed air tools. For the last half-century this firm had been engaged in the manufacture of compressed air machinery, and can, therefore, claim a knowledge built on experience. The booklet contains extensive views of the Company's workshops at Camborne, and illustrates very fully the many types of pneumatic machinery produced by this old-established firm. Complete catalogues of all mining, or quarrying, &c., tools will be forwarded on application to their head office.

The Louvre Stoker.

The Underfeed Stoker Company have for the last thirty years been in the forefront of combustion equipment design; and installations of plant bearing testimony to this fact are to be found in almost every centre of activity throughout the world. The Company have recently published a brochure dealing with their new type of travelling grate stoker, known as type "L." Though the machine was designed primarily for new and large boilers, it is capable of improving considerably the efficiency, and increasing the output, of existing boilers, or, alternatively, of maintaining the efficiency and output when using cheaper fuel.

The Largest Searchlight in the World.

The London Electric Firm have recently completed the largest searchlight in the world. Such searchlights are used for fortress use by a Continental Power. They are nearly 7 ft. in diameter, and the candlepower being approximately 3500 million, they would be visible for hundreds of miles could the limitations of the horizon be overcome. They are arranged for working up to an elevation of 90°, and the operator can be located far away from the machine, and yet control the entire movements from the portable controller which he carries about with him. In addition to the manufacture of the largest searchlights, the Company also make the smallest, and all the intervening sizes and types, both electrical and acetylene.

CURRENT SALES OF GAS PRODUCTS.

The London Market for Tar, Tar Products, and Sulphate.

LONDON, *Nov.* 19.

The market for tar products continues steady.

Pitch is unchanged at about 40s. to 42s. 6d. per ton.

Creosote is quiet at about 7d. per gallon.

Tar spirits are as follows: Pure benzole, about 1s. 8d. per gallon; pure toluole, 1s. 11d. to 2s. per gallon; 95/160 solvent naphtha, about 1s. 6d. per gallon; pyridine is about 5s. per gallon.

Tar Products in the Provinces.

Nov. 20.

The markets for tar products generally are unaltered.

The market for pitch is still weak, and there is little or no business doing.

Creosote is quiet, but there is still a fair amount of demand for home consumption.

There is no alteration in the market for water-white products, which are still very firm.

Crude carbolic acid is without alteration.

Cresylic acid has been in a little more demand, particularly the higher grades.

The average prices of gas-works products during the week were: Gas-works tar, 29s. to 34s. Pitch—East Coast, 37s. 6d. to 47s. f.o.b. West Coast—Manchester, 32s. 6d. to 33s. 6d.; Liverpool, 34s. 6d. to 35s. 6d.; Clyde, 34s. 6d. to 35s. 6d. Toluole, naked, North, 1s. 5d. to 1s. 6d. nominal. Coal-tar crude naphtha, in bulk, North, 9d. to 10d. Solvent naphtha, naked, North, 1s. 1½d. to 1s. 2d. Heavy naphtha, North, 1s. to 1s. 0½d. Creosote, in bulk, North, liquid, 5⅝d. to 5⅞d.; salty, 5½d. to 5¾d.; Scotland, 5½d. to 5¾d. Heavy oils, in bulk, North, 8½d. to 8¾d. Carbolic acid, 60 p.c., 1s. 11d. to 2s. prompt. Naphthalene, £13 to £15; salts, £5 to £5 10s., bags included. Anthracene, "A" quality, 2½d. per minimum 40 p.c., purely nominal; "B" quality, unsaleable.

Benzole Prices.

The following are considered to be the market prices to-day:

	s. d.		s. d.	
Crude benzole	0 10	to	0 10½	per gallon at works
Motor "	1 4	"	1 4½	" " "
90 p.ct. "	1 7	"	1 8	" " "
Pure "	1 10	"	1 11	" " "

Nursery Rhymes for Modern Times.—The "B.C.G.A." have recently published an attractively illustrated little booklet of nursery rhymes, with a view to advocating the all-gas home, and the abolition of the smoke nuisance.

Cullompton Gas Company Purchased.—The Cullompton Gas Company has been acquired by the Devon Gas Association. Mr. G. Brooks will remain Manager, and all the other employees will be retained. It is interesting to note that the Cullompton Gas Company held its first meeting at the White Hart Hotel on April 10, 1865, and all the subsequent meetings have been held in the same place.

L.C.C. Meter Testing.—At the meeting of the London County Council Public Control Committee on Nov. 6, it was reported that during the year ended March 31, 1928, a total of 320,256 dry gas meters were tested at the Council's offices, and 67,634 were rejected; and of 79 wet meters tested, 18 were rejected. Of those tested *in situ*, 12 dry meters were stamped and 3 rejected; and of 35 wet meters, 1 was rejected. There had been a large increase in verification work during the year; 64,933 more meters being tested than in the previous year, while the fees received showed an increase of £3688. The total income from fees and miscellaneous sources amounted to £24,450.

Helston Gas Undertaking.—On the occasion of his re-election as Mayor of Helston for the third year in succession, Alderman J. B. Martin said that, as Chairman of the Gas Committee, he had to face a great deal of criticism, some of which had not been quite fair. When the Corporation took over the gas undertaking, they realized that they were acquiring an old concern, and the reason he favoured the Council's taking this step was because he believed that by so doing they would obtain better lighting. There was a feeling that since electric lighting had come into the town there would be no further use for gas; but he knew of no place where the introduction of electric light had not stimulated the sales of gas companies. Everything, he continued, had been done to improve the gas supply. A new holder was now in course of construction, and when it was completed he considered that the supply of gas at Helston would be as good as any in the west of England.

The new main road between Rhyl and Prestatyn is now being lighted with gas as far as the Rhyl boundary.

Negotiations are proceeding at the Evenwood Colliery in an endeavour to reach an agreement on the cokemen's wages. If the terms laid down by the management are accepted, it is anticipated that the bye-product ovens will be relighted at an early date. Before closing down in June, 1927, the colliery employed over 1000 men and boys.

While in their house in Well Street, Glasgow, on Nov. 10, an elderly people were overcome by gas fumes, and had to be removed to the Royal Infirmary. It is stated that two employees of the Glasgow Corporation Gas Department had been engaged in cleaning a choked pipe underneath a window at the back of the house occupied by the couple. After turning on the gas it was discovered that the pipe had broken, and gas had penetrated into the dwelling.

STOCK MARKET REPORT.

THE Stock Exchange markets were very depressed last week. Speculative shares suffered a severe bout of selling, and, apart from American buying of a few favourites, prices dropped considerably. From the speculative point of view the Account was a disastrous one, and it is possible that some difficulty will be experienced in negotiating the Settlement. At one time adverse gold movements threatened to affect gilt-edged securities; but the position improved, and the market finished with pronounced strength.

The previous activity in the Gas Market continued during the whole week, and one might almost imagine that a miniature boom was in progress. There were numerous transactions, and all available stock was easily sold. Although there was no sensational rise in the quotation on any stock, prices, with the exception of Primitiva ordinary, which fell back 1s., were well maintained. The low price of East Hull ordinary 5 p.ct. would appear to require the attention of interested parties. The average price (76½) compares unfavourably with the Bristol 5 p.ct. maximum at 92 on the same dividend of 5 p.ct.

The following transactions were recorded during the week:

On Monday, Alliance and Dublin 97¼, Bournemouth 6 p.ct. pref. 11, 11½, British 115, Colombo 40s., 40s. 3d., Commercial 100, Croydon 111½, European 8, Gas Light and Coke 18s. 9d., 19s., 3½ p.ct. 63¼, 63⅜, 64½, 4 p.ct. pref. 77, 77⅜, Primitiva 24s., 24s. 3d., 24s. 4½d., 24s. 6d., 24s. 7½d., South Metropolitan 107½, 107⅝, 108, 6 p.ct. pref. 111½, 111⅝, 112½, South Suburban 5 p.ct. deb. 99, Southampton 5 p.ct. 79, Wandsworth, Wimbledon 5 p.ct. 109½, 110½, Epsom 5 p.ct. 117½, 119. Supplementary prices, Aldershot 4 p.ct. deb. 73½, British 6 p.ct. deb. (Norwich) 100, 100¼, Gas Light and Coke 5 p.ct. deb. 102, Hartlepool consolidated 82, South Suburban new 5 p.ct. 110.

On Tuesday, Alliance and Dublin 98, Bombay 21s. 9d., Bristol 92¾, British 116, 116½, European 8⅛, 8¼, Gas Light and Coke 18s. 9d., 18s. 10½d., 19s., 4 p.ct. pref. 76⅜, 77, 77⅛, 3 p.ct. deb. 61, 61¼, Imperial Continental 107½, 168½, 169, 169½, Primitiva 23s. 10½d., 24s., 24s. 1½d., 24s. 3d., 4 p.ct. con. deb. 79, South Metropolitan 107⅞, South Suburban 5 p.ct. 110, 5 p.ct. deb. 99½, 100, Wandsworth "C" 100, 101, Epsom 5 p.ct. 119½. Supplementary prices, Aldershot "A" 82, "B" 61½, Dover 7½ p.ct. 116½, 117, Gas Light and Coke 5 p.ct. deb. 102, Hartlepool 5 p.ct. 83, Romford "B" 8½, South Suburban new 5 p.ct. 109½, 110, Southend-on-Sea new "B" 85.

On Wednesday, Bristol 5 p.ct. max. 92¾, British 116½, Commercial 99, 99½, 100, 100½, 3 p.ct. deb. 58½, Continental Union 38, Gas Light and Coke 18s. 9d., 18s. 10½d., 18s. 11¼d., 19s., 3½ p.ct. max. 64, 4 p.ct. pref. 76½, 77½, 3 p.ct. deb. 61½, Imperial Continental 168½, Liverpool 7 p.ct. pref. 101, 102, 102½, Montevideo 97, 98, Portsmouth 4 p.ct. 102½, 5 p.ct. max. 81, Primitiva 23s. 9d., 24s., South Metropolitan 106½, 107, 107½, 107¼, 107⅜, 108, 3 p.ct. deb. 60½, South Suburban 5 p.ct. deb. 99¼, Tuscan 20s. 1¼d., 20s. 6d., Wandsworth "B" 115½, Epsom 5 p.ct. 119, 3 p.ct. deb. 57, 4 p.ct. deb. 76. Supplementary prices, Gas Light and Coke 5 p.ct. deb. 102; Liverpool 5 p.ct. 90½, Southend-on-Sea 92.

On Thursday, Alliance and Dublin 97½, 98, Cardiff 97½, Continental Union 37, Croydon sliding-scale 111½, 112½, European 8⅛, Gas Light and Coke 18s. 9d., 18s. 10½d., 18s. 11¼d., 4 p.ct. pref. 76½, 77, 77⅜, 3 p.ct. deb. 60½, Imperial Continental 167½, Primitiva 23s. 9d., 24s., South Metropolitan 106⅜, 107, 108, 6½ p.ct. deb. 101½, South Suburban 5 p.ct. 109⅞, 110, Swansea 7 p.ct. pref. 102, Tuscan 20s., Wandsworth, Wimbledon, new 100. Supplementary prices, Gas Light and Coke 5 p.ct. deb. 102, Romford "B" 8½, Tottenham 5 p.ct. pref. 90½.

On Friday, Commercial 99½, 3 p.ct. deb. 58½, Continental Union 37, Gas Light and Coke 18s. 9d., 18s. 10½d., 19s., 3½ p.ct. max. 63, 63½, 63⅝, 63¾, 64, 4 p.ct. pref. 77, 77⅛, 77⅝, 77⅞, 3 p.ct. deb. 60½, 61, Hornsey 3½ p.ct. 89, Imperial Continental 3½ p.ct. deb. 68½, Montevideo 97½, 98½, Primitiva 23s. 9d., 24s., South Metropolitan 107, 107½, 107¼, 107⅜, 6½ p.ct. deb. 101½, South Suburban 5 p.ct. deb. 100, Tottenham "B" 102, Wandsworth, Wimbledon new 101. Supplementary prices, Gas Light and Coke 5 p.ct. deb. 1952-57 102, Hornsey new 5 p.ct. pref. 87.

In Lombard Street short money was plentiful, 3½ p.ct. being charged at the end of the week for both old and new loans. Balances, however, were offered at 3 p.ct. There were rumours of gold export; but these did not mature, and discount rates remained unchanged. Treasury Bills were allotted at nearly 3d. p.ct. above the previous week's average at £4 8s. 0·47d. p.ct.

Interest in the Foreign Exchange Market was centred in the New York rate, which moved up and closed at 4.84$\frac{29}{32}$. In European currencies, French francs at 124$\frac{3}{4}$, German marks at 20.35½, Dutch florins at 12.07$\frac{15}{16}$, and Italian lire at 92.54½, all moved in this country's favour. Pesetas at 30.08 and Belgas at 34.89¼ were unchanged.

Silver, with Indian support, was steady at 26$\frac{3}{4}$d. per oz.; and Gold remained at the nominal price of 84s. 11½d. per oz.

The Bank Rate is 4½ p.ct., to which it was reduced from 5 p.ct. on April 21, 1927. The Banks' deposit rate is 2½ p.ct., and the deposit rates of the discount houses are 2$\frac{5}{8}$ p.ct. at call and 2$\frac{7}{8}$ p.ct. at notice.

Issue.	Share.	When ex-Dividend.	Dividends. Prev. Hf.Yr	Dividends. Last Hf. Yr.	NAME.	Quotations. Nov. 16.	Rise or Fall on Week.	Transactions Lowest and Highest Prices.
£			%p.a	% p.a.				
171,978	Stk.	Aug. 30	5	5	Aldershot 5 p.c. max. C.	72—77	..	..
413,992	"	"	4	4	Do. 4 p.c. Pref.	68—71	..	..
1,561,868	"	Sept. 27	7	7⅛	Alliance & Dublin Ord.	96—99	+1	97¼—98
174,000	"	July 12	4	4	Do. 4 p.c. Deb.	63—66	..	..
523,654	"	Aug. 30	7	7	Barnet Ord. 7 p.c.	114—117	..	..
900,000	1	Oct. 11	1/7½	1/4½	Bombay, Ltd.	20/—22/-	..	21/9
170,000	10	Aug. 30	8½	8½	Bournemouth 5 p.c.	12½—13½	..	..
600,050	10	"	7	7	Do. B 7 p.c.	12½—13⅝	..	..
375,000	10	"	6	6	Do. Pref. 6 p.c.	10¼—11¼	..	11—11¼
50,000	Stk.	July 12	3	3	Do. 3 p.c. Deb.	56—59	..	..
163,025	"	"	4	4	Do. 4 p.c. Deb.	75—78	..	..
357,960	"	Aug. 30	7½	7½	Brighton & Hove 6 p.c. Con	115—118	..	..
311,880	"	"	6½	6½	Do. 5 p.c. Con.	101—104	..	..
1,287,500	"	July 26	5	5	Bristol 5 p.c. max.	91½—92½a	+½	..
565,000	"	Sept. 27	7	8	British Ord.	114—117	..	115—116¼
400,000	"	June 28	7	7	Do. 7 p.c. Pref.	114—117	..	..
120,000	"	"	4	4	Do. 4 p.c. Red. Deb.	74—77	..	..
400,000	"	"	5	5	Do. 5 p.c. Red. Deb.	95—98	..	..
160,000	10	May 24	6	8	Cape Town, Ltd	8—9	..	..
160,000	10	Oct. 25	4½	4½	Do. 4½ p.c. Pref.	6¼—7¼*	..	..
150,000	Stk.	June 28	4½	4½	Do. 4½ p.c. Deb.	73—78	..	..
598,860	"	July 26	6	6	Cardiff Con. Ord.	97—100	..	97½
487,860	"	June 28	7½	7½	Do. 7½ p.c. Red. Deb.	100—103	..	..
157,150	"	Aug. 16	6½	5	Chester 5 p.c. Ord.	88—93b	..	..
79,185	1	Oct. 11	12/-	12/-	Colombo Ltd. Ord.	39/—41/-	..	40/—40/3
24,495	1	"	1/4⅜	1/4½	Do. 7 p.c. Pref.	20/6—22/6	..	..
375,402	1	Oct. 11	1/9⅜	1/9½	Colonial Gas Assn. Ld. Ord	23.6—25/6	+·/6	..
187,948	1	"	1/7½	1/7½	Do. 8 p.c. Pref.	21/—23/-	..	..
2,621,280	Stk.	July 26	7	5	Commercial Ord.	98—101	..	99—100½
475,000	"	June 14	8	8	Do 8 p.c. Deb.	57—60	..	58A
920,000	"	Sept. 27	11	11	Continental Union, Ltd.	36—39	..	37—38
460,000	"	"	7	7	Do. 7 p.c. Pref.	90—95	..	..
187,500	"	Aug. 16	7	7	Croydon sliding scale	110—113	..	111¼—112½
483,100	"	"	5	5	Do. max. div.	84—87	..	..
692,370	"	Aug. 16	10	7	Derby Con.	115—120c	..	..
55,000	"	June 28	4	4	Do. Deb.	71—73c	..	..
400,000	"	Aug. 30	5	5	East Hull Ord. 5 p.c.	75—78	..	..
1,332,180	10	Sept. 13	16	14	Eurcpean, Ltd.	8—9	..	8—8½
18,704,480	Stk.	July 26	5/1/4	5½	Gas Light & Coke 4 p.c. Ord.	18/9—19/3f	..	18/9—19/-
2,400,000	"	"	8½	8½	Do. 8½ p.c. max.	62½—64½	..	63—64½
4,127,020	"	"	4	4	Do. 4 p.c. Con. Pref.	76—79	..	76½—77½
5,899,620	"	June 14	8	8	Do. 8 p.c. Con. Deb.	60½—62½	..	60⅝—61½
181,315	"	"	6	6	Do. 6 p.c. Br'tf'd Rd. Db.	104—107	+1	..
1,643,770	"	"	5	5	Do. 5 p.c. Red. Deb.	99—101	..	..
42,000	"	—	7½	7½	Do. 7½ p.c. Ilford Deb.	..	..	..
82,500	"	Aug. 30	6⅔	7	Hastings & St L. 5 p.c. Conv	95—100	..	..
220,740	"	"	5⅓	5½	Do. 8½ p.c Conv.	75—80	..	..
70,000	10	Oct. 11	†10	†10	Hongkong & China, Ltd.	18—14	..	..
173,300	Stk.	Aug 30	5	5½	Hornsey Con. 8½ p.c.	88—91	..	89
1,920,000	"	Nov. 8	10	10	Imperial Continental Cap.	167—172*	−1	167½—169½
933,120	"	Aug. 16	8½	8½	Do. 8½ p.c. Red. Deb.	67—69	..	68½
335,349	"	Aug. 16	7	7½	Lea Bridge 5 p.c. Ord.	98—101	..	..
2,145,967	"	Aug. 16	6½	5½	Liverpool 5 p.c. Ord.	90—91b	..	..
600,000	"	Sept 27	7	7	Do. 7 p.c. Red. Pref.	101—102b	−1½	..
186,796	"	Aug. 16	8	9	Maidstone 5 p.c. Cap.	120—125	..	..
69,180	"	June 14	3	3	Do. 3 p.c. Deb.	55—58	..	..
75,000	5	June 14	18	18	Malta & Mediterranean	5½—6	..	..
841,920	Stk.	May 24	16	17	Montevideo, Ltd.	97—99	+1	97—98½
1,061,312	"	Aug. 16	6	5	Newcastle & Gateshead Con.	16/3—16/9d/f	+·/1½	..
980,920	"	"	4	4	Do. 4 p.c. Pref.	70½—71½d	−1	..
601,720	"	June 28	8½	8½	Do. 8½ p.c. Deb.	69¼—70¼d*	..	..
131,760	"	Aug. 30	6/18/0	7/1/0	North Middlesex 6 p.c. Con.	102—107	..	..
350,000	"	Apl. 26	9	7	Oriental, Ltd.	115—118	..	..
189,130	"	June 28	7½	7½	Plym'th & Stonehouse 5 p.c.	110—113	..	..
414,600	"	Aug. 30	7⅝	7⅝	Portsm'th Con. Stk. 4p.c. Std.	101—104	..	102½
396,782	"	"	5	5	Do. 5 p.c. max.	79—82	..	81
3,334,462	1	—	—	—	Primitiva Ord.	23/—25/-	−1/-	23/9—24/7½
214,500	100	June 1	4	4	Do. 4 p.c. Red. Deb.	91—94	..	..
605,000	Stk.	July 26	4	4	Do. 4 p.c. Red. Deb. 1911	78—80	..	..
416,345	"	June 28	4	4	Do. 4 p.c. Cons. Deb.	78—80	..	79
150,000	10	Sept. 27	6	6	San Paulo 6 p.c. Pref.	87—88	..	..
770,000	Stk.	Aug. 30	6	6½	Sheffield A	104—105e	..	..
419,968	"	"	6	6½	Do. B	104—105e	..	..
1,047,000	"	"	6	6½	Do. C	104—105e	..	..
90,000	10	June 14	13	14	South African	4—6	..	..
6,609,895	Stk.	July 26	7½	5	South Met. Ord.	106½—108½	−½	106½—108
500,000	"	"	6	6	Do. 5 p.c. Irred. Pf.	110—113	..	111½—112½
1,895,445	"	July 12	8	8	Do. 5 p.c. Deb.	59—61	..	60½
734,000	"	Sept 13	6½	6½	Do. 5½ p.c. Red. Db.	100—102	..	101½—101½
91,500	"	Aug. 16	8½	8½	South Shields Con.	109—110d	..	..
1,443,795	"	July 26	6½	6½	South Suburban Ord. 5 p.c.	108—111	..	109½—110
368,887	"	June 28	5	5	Do. 5 p.c. Deb.	98—101	..	99—100
647,740	"	Aug. 30	5	5	South'mpton Ord. 5 p.c. max.	77—79	..	79
121,275	"	June 28	4	4	Do. 4 p.c. Deb.	72—75	..	..
350,000	"	Aug. 30	7	7	Swansea 7 p.c. Red. Pref.	101—103	..	102
300,000	"	June 28	6½	6½	Do. 6½ p.c. Red. Deb.	101—103	..	..
120,000	"	July 26	7½	8	Tottenham District A 5 p.c.	117—122	..	..
989,276	"	"	6½	6½	Do. B 5½ p.c.	100—103	..	102
180,000	"	"	5½	5½	Do. 5½ p.c. Pref.	96—99	..	..
181,365	"	June 14	4	4	Do. 4 p.c. Deb.	76—79	..	..
289,094	"	Aug 30	6$\frac{5}{16}$	6⅞	Uxbridge, Maidenhead, & Wycombe 5 p.c.	90—95	..	..
88,330	"	"	5	5	Do. 5 p.c. pref.	87—92	..	..
80,000	"	July 12	8½	8½	Wandsworth, Wimbledon, and Epsom— Wandsworth A 5 p.c.	130—135	..	..
255,826	"	"	7	7½	Do. B 5½ p.c.	113—118	+1	115½
423,535	"	"	5/19/0	6½	Do. C and New	98—103	..	100—101
352,000	"	"	6⅝	6⅝	Do. Wimbledon 5 p.c.	107—112	..	109½—110½
96,000	"	"	7½	7½	Do. Epsom 5 p.c.	115—120	..	117½—119½
200,000	"	"	5	5	Do. 5 p.c. Pref	88—91	..	..
88,416	"	June 28	8	8	Do. 8 p.c. Deb.	56—59	..	57
284,742	"	"	4	4	Do. 4 p.c. Deb.	75—78	..	76
207,500	"	"		5	Do. 5 p.c. Deb.	98—100	..	..

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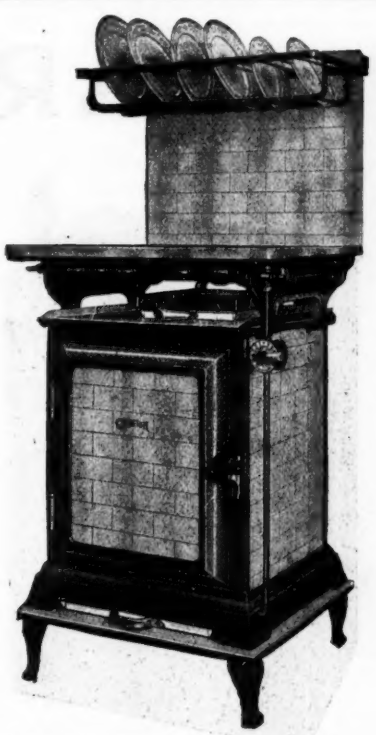

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